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FAO — The Food and Agriculture Organization of the United Nations — grew out of a United Nations Conference held at Hot Springs, Virginia, U.S.A., in May 1943. The nations agreed to work together to secure a lasting peace through freedom from want. The Organization was formally founded at Quebec, Canada, in October 1945. It was located at Washington D.C. until 1951 when the Headquarters office was moved to Rome.

Unasylva is prepared by the Forestry and Forest Products Division, directed by Mr. Egon Glesinger, and published every quarter in English, French and Spanish. It attempts to cover a range of interest as wide as that of the Forestry Division whose work it mirrors. Signed articles express the opinions of the authors and do not necessarily represent the views of the Organization. All material in ***Unasylva*** may be freely reprinted, but acknowledgment is requested, together with a copy of the publication containing the reprint.

Cover Photograph. *There is a direct relationship between the consumption of printing and writing paper and newsprint, on the one hand, and economic, social, educational and cultural activity, on the other. This was agreed at the FAO World Consultation on Pulp and Paper Demand, Supply and Trade held at Rome in September. In the less developed countries the relationship takes on a special significance and efforts to accelerate advancement would be impossible without increased availability and consumption of paper. This photograph simply but strikingly focuses attention on the enormous potential needs of millions of the world's illiterates for paper in the form of primers and schoolbooks. When these children grow up, they will want to read newspapers too.*

Courtesy: *The Bowater Paper Corporation Ltd.*

Unasylva

An International Review of Forestry and Forest Products

PULP AND PAPER PROSPECTS

World consumption of paper and paperboard has doubled within the past 20 years, passing from 28 million metric tons in 1938 to over 62 million in 1958. On the basis of prospective population growth and general economic development, it should more than double within the next 15 years.

This is an assessment put forward by the world's leading experts attending the FAO World Consultation on Pulp and Paper Demand, Supply and Trade held at Rome in September. They put consumption at 88 tons by 1965 (of which 17 million would be newsprint) and 134 million tons by 1975 (26 million being newsprint). Domestic consumption in North America alone would then reach 57 million tons (10 million tons being newsprint) and 27 million in Western Europe (6 million tons being newsprint). Industry already has plans for expanding its capacity which will take care of most of the increase expected up to 1965.

To produce the additional pulp needed by 1975, roughly 280 million solid cubic meters more roundwood will be required if the pulp is manufactured from wood alone. This corresponds to about one third of the current removals of wood for industrial use. The Consultation noted that supply difficulties already exist or may arise in the foreseeable future in Eastern Europe, the Near East and in some parts of the Far East. Even in Western Europe sustained efforts will be needed if difficulties are to be avoided. It emphasized the importance of making long-term plans to secure the industry's future needs in raw materials.

To meet rising needs, substantial investments will be required, averaging (at current prices) more than U.S. $1,000 million annually to 1965 and perhaps $1,500 million annually in the decade 1965-75. It is in the deficit regions that investment needs will rise most rapidly, and in the developing countries there will be both scope and need for investment from overseas.

Today only two regions, North America and Western Europe, are net exporters; together they represent four fifths of world production. All other regions depend in varying degrees on supplies from these two regions, ranging from one third of the domestic consumption in the case of Latin America to two thirds in the case of Africa.

These other regions have ambitious plans for developing their pulp and paper industries. Already production has risen sharply over the last decade. Simultaneously, their net imports of paper have risen by 40 percent and those of pulp have doubled. These regions cannot afford an unlimited increase in paper imports. Vigorous efforts to raise domestic supplies will be needed if they are not to restrict their consumption. Shortage of paper could frustrate their economic, educational and social progress.

The Consultation agreed on the need for a marginal reserve capacity if market stability is to be assured. All-out capacity is unlikely to be realized in practice, and there is need for a cushion to absorb temporary unexpected increases in demand as well as unforeseen setbacks in the production schedule. There have been times since 1945 when the industry in several countries has operated for prolonged periods at close to maximum capacity. This has encouraged investors, and by 1958 had brought into existence throughout the world roughly 4½ million tons more capacity than would have been needed to satisfy consumption even had demand grown normally, i.e., had there not been a setback to general economic expansion in 1957/58.

International trade in pulp and paper has grown to the point where, at close on $3,000 million, it accounts for over 3 percent by value of total world trade. This compares with less than 5 percent for iron and steel. The total level of world trade in wood pulp now stands at 7½ million tons (4½ million tons in 1948) and that in paper and board has reached 10½ million tons (6½ million tons in 1948). In recent years, the U.S.S.R. and Eastern Europe have expanded their trade in pulp and paper, exporting close on 300,000 tons of both pulp and paper in 1958. These exports were balanced by imports of roughly the same order. Domestic requirements are rising rapidly in these regions and the Consultation, on the basis of information communicated, did not think that export availabilities would rise in these areas in the coming years on a scale likely to affect world market stability.

The Consultation, which was attended by 27 experts and advisers from 16 countries, elected as its Chairman, Mr. Robert M. Fowler, President of the Canadian Pulp and Paper Association.

FIGURE 1. – *The forest face of British Columbia is slowly changing as more and more industrial operations are based on the sustained-yield concept and patch-strip-single-tree selection techniques become more common.*

All photographs, Courtesy, B. C. Forest Service

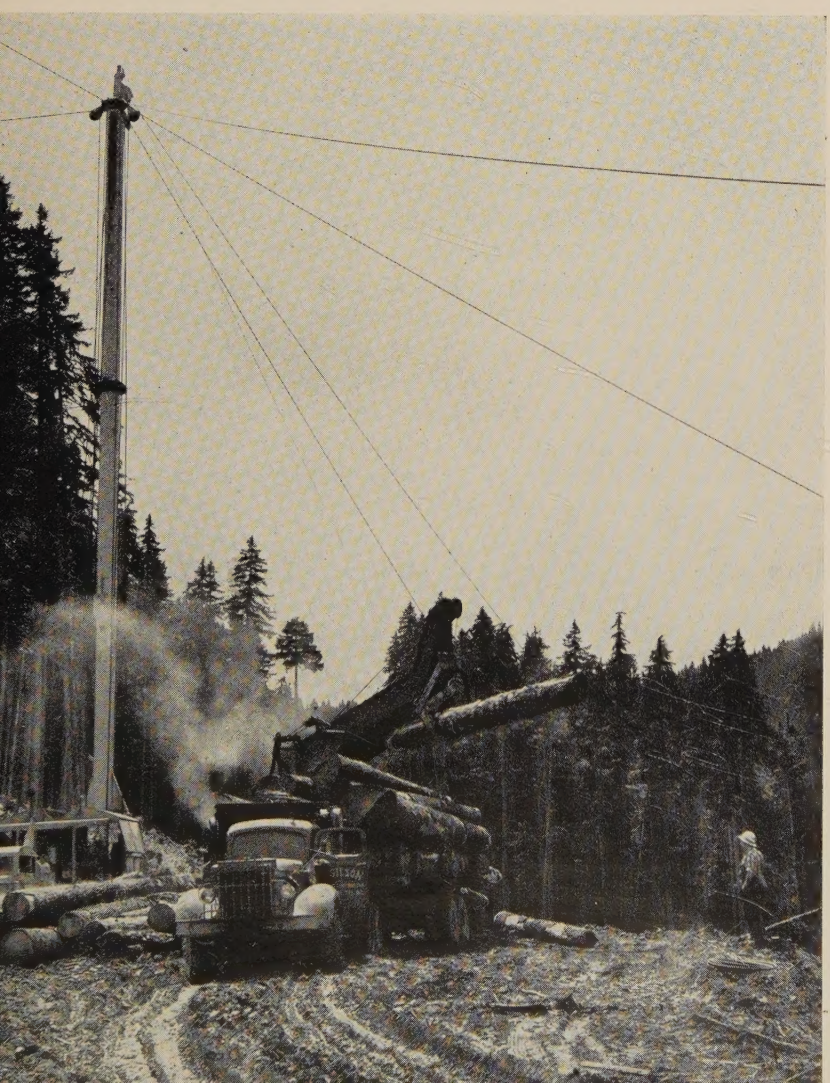

FIGURE 2. – *A typical coastal British Columbia loading operation. The mobile spar-tree for the high-lead system and the Diesel-powered, separate loading shovel mark this setting as up to date.*

Canada's Pacific Forests

R. G. McKee,
Deputy Minister of Forests, British Columbia, Canada

As the year 1958 marked British Columbia's first century as a Province of Canada, so the completion of the first decade of sustained-yield forest policy in the Pacific Province also had a special, additional significance to professional foresters.

Although the two events may appear, at first glance, to be separate and distinct they are, in fact, synonymous to a great degree. British Columbia's economic and social history is forest history. This is a forest land, the so-called forest province of a forest nation. Deeply integrated into the very sinews of the province and her people are their forests. With her forests, British Columbia ranks among the leading softwood-growing areas in the world. Without her forests, she would be a very poor area indeed.

The forests of British Columbia provide her people with a high standard of living as a result of the sale of forest products: but they mean much more than this. They mean recreation in all its outdoors aspects and they mean hydro-electric power sources with their variety of ramifications.

There is little argument that this is a forest land. Of the 366,000 square miles (94,794,000 hectares) comprising the total area of the province, 60 percent is forest land and, so far as we know today, best suited for the growing of a forest crop. According to the latest estimates, there are 184,375 square miles (47,753,125 hectares) of commercial forest stands at present day utilization standards.

Four percent of the Province is suitable for agriculture and the remainder is barren rock and water.

Over the past five years, the industrial forest harvest has averaged 982,000,000 cubic feet (27,800,000 cubic meters) per year with an average annual value to the Province of well over $500,000,000 (Table 1).

TABLE 1. – ESTIMATED VALUE OF PRODUCTION, INCLUDING LOADING AND FREIGHT WITHIN THE PROVINCE, 1949-58

Product	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	Ten-year average, 1949-58
Lumber	$206,228,610	$303,384,304	$278,904,266	$280,006,490	$279,979,507	$270,109,948	$348,264,190	$328,262,772	$275,373,764	$225,626,861	$279,614,071
Pulp and paper	68,482,241	78,739,573	135,167,761	129,238,520	135,871,797	156,178,180	166,902,992	176,295,267	177,431,513	190,750,417	141,505,826
Shingles	16,881,240	37,502,958	32,537,442	23,878,880	26,700,153	28,077,416	29,488,730	24,407,817	18,421,952	19,546,449	25,744,304
Boxes	3,424,268	3,837,067	4,062,133	2,367,450	1,810,376	1,481,051	1,374,984	647,112	1,089,400	854,922	2,094,876
Plywood	21,500,000	26,250,000	34,500,000	36,572,000	45,240,000	53,000,000	68,000,000	80,000,000	71,845,000	90,000 000	52,690,700
Piles, poles, and mine-timber	4,470,379	5,127,681	5,805,745	9,540,340	8,646,611	5,087,052	6,283,909	9,301,902	12,834,152	5,686,592	7,278,436
Cordwood, fence-posts, and lagging	2,058,200	2,189,249	2,349,720	2,675,870	2,581,806	2,282,996	1,447,950	1,391,960	919,538	765,270	1,866,256
Ties, railway	467,127	281,308	633,089	963,200	669,007	445,777	306,625	615,491	1,068,280	296,919	574,682
Additional value contributed by the wood-using industry	2,000,000	2,250,000	2,812,500	2,530,000	2,530,000	2,530,000	2,530,000	2,750,000	2,500,000	2,200,000	2,463,250
Laths and other miscellaneous products	1,454,000	1,723,616	1,994,340	2,164,660	2,688,007	1,845,901	1,595,900	1,306,988	986,082	757,058	1,651,655
Logs exported	4,029,069	5,741,784	4,981,597	5,401,410	4,514,777	5,918,306	4,413,508	2,342,700	1,343,090	474,520	3,916,076
Pulpwood exported	139,200	741,128	99,375	236,900	37,296	85,716	480	—	—	—	134,010
Wood-chips exported	—	—	—	—	—	—	—	—	6,875,000	4,854,232	1,172,923
Christmas trees	445,965	583,549	939,390	912,700	999,159	968,047	1,085,045	1,258,443	1,126,918	964,985	928,420
Cascara bark	9,250	18,925	20,572	18,130	20,160	12,393	5,249	6,511	14,880	9,202	13,527
TOTAL	$331,589,549	$468,371,142	$504,807,930	$496,506,550	$512,288,656	$528,022,783	$631,699,562	$628,586,963	$571,829,569	$542,787,427	$521,649,012

It is estimated that 70-80,000 persons are directly employed in the forest industries which makes it by far the greatest single employer of labor. Forty cents of every dollar earned within the Province originates in the forests.

During the last decade, some $1,000 million of new capital investment has gone into the expansion of existing forest manufacturing facilities and the creation of new plant.

The resource that supports this large and complex industry is a virile and multi-aged one. The sound wood volume estimate stands at 306 thousand million cubic feet (8.7 billion cubic meters); the net annual growth at 2.3 thousand million cubic feet (65,136,000 cubic meters); and the net annual depletion rate at 2.2 thousand million cubic feet (62,304,000 cubic meters).

From the standpoint of position in Canada's national forest industry picture, statistics bear out the statement, that, in production, British Columbia is the forest province. For example, 63.9 percent of Canada's dollar value of production of lumber comes from British Columbia; 63 percent of the national value of plywood production; and 36.7 percent of the national net value of logging. The pulp and paper industry of the Province accounts for 13 percent of the Canadian total (this has almost doubled in the last decade) (Table 2): 70 percent of Canada's total lumber exports comes from there as does 16 percent of Canadian pulp and paper shipments abroad (Table 3).

From an administration standpoint it is obvious that the very size of the resource would present some considerable problems. These problems are compounded, however, by such natural phenomena as the extreme ruggedness of much of the provincial topography, the great distances and lack of ready access to much of the forested area, the economic and biotic division of the Province into " coast " and " interior ". The traditional ownership pattern for forest land places 93 percent

TABLE 2. – PAPER PRODUCTION, 1949-58
(in tons)

Product	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	Ten-year average, 1949-58
Newsprint	378,355	388,191	385,172	428,832	501,083	536,656	560,993	595,717	583,850	608,743	496,959
Other papers	83,927	89,437	99,409	92,777	96,853	110,461	127,880	112,299	157,872	200,406	117,132

In addition to 759,493 tons of pulp manufactured into paper in the Province, 663,727 tons were shipped out of the Province during the year.

TABLE 3. – WATER-BORNE LUMBER TRADE, 1949-58
(in thousand board feet)

Destination	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	Ten-year average, 1949-58
Eastern Canada	—	—	—	—	6,708	5,670	3,037	4,917	2,102	5,482	2,792
Australia	83,523	90,936	93,566	36,060	89,658	115,464	137,308	99,829	87,213	98,808	93,236
New Zealand	10,702	8,823	13,311	7,839	6,036	13,465	12,588	14,097	11,030	8,397	10,629
South America	7,234	2,227	2,067	2,164	3,924	648	5,756	16,541	25,503	8,816	7,488
China, Hong Kong, and Formosa	4,318	7,087	21,382	7,915	9,206	3,599	1,909	1,275	1,256	597	5,854
Japan and Korea	—	86	101	82	23,742	8,216	10,725	5,852	3,713	999	5,352
United Kingdom	345,812	243,632	763,267	772,527	502,814	697,298	611,451	320,293	385,237	337,959	498,029
Africa	101,957	89,152	94,412	52,344	123,064	145,308	188,567	145,132	181,560	139,523	126,102
India	12,261	2,621	7,396	1,029	16,695	4,397	1,745	416	468	3,372	5,040
United States	310,411	736,831	71,316	229,809	542,472	509,661	345,694	283,834	275,452	602,427	390,791
Philippine and Hawaiian Islands	11,086	13,112	11,353	9,558	7,577	4,998	12,715	13,183	7,668	3,166	9,442
West Indies	9,754	8,654	9,669	3,404	12,235	12,062	10,516	11,599	12,085	13,492	10,347
South Sea Islands	7,668	7,751	9,917	8,538	8,563	8,402	16,140	15,339	8,147	11,841	10,231
Mexico and Central America	4,619	89	762	463	269	29,192	33,788	41,937	49,885	51,842	21,285
Egypt, Arabia, and Israel	11,744	7,634	22,426	498	2,191	2,368	1,320	1,394	5,766	213	5,555
Belgium	3,202	8,958	[1]	2,390	8,951	4,977	3,121	2,628	5,095	10,790	5,011
France	1,841	—	1,672	1,172	1,382	2,950	2,845	3,191	4,110	3,265	2,243
Germany	51	—	291	73	105	15	732	177	169	22	163
Holland	1,945	1,917	[1]	1,217	4,524	4,123	4,042	3,802	3,552	6,091	3,121
Italy	294	549	1,221	637	1,084	2,284	4,349	3,007	6,530	4,560	2,451
Foreign, unclassified	6,939	20,423	13,335	10,107	20,217	4,674	3,603	1,221	2,363	2,681	8,556
Belgium and Holland	—	—	7,720	—	—	—	—		—	—	772
Denmark, Norway, and Sweden	309	714	1,107	227	247	175	109	—	14	18	292
TOTAL	935,670	1,251,196	1,146,291	1,148,053	1,391,664	1,579,946	1,412,060	989,664	1,078,918	1,314,361	1,224,782

[1] Belgium and Holland combined in 1951.

of all accessible mature forests under the jurisdiction of the Provincial Crown administered by the Forest Service. In addition, there are such factors as the complete dependence on export markets for our forest products and the consequent over-heavy concentration of large-scale industry on the lower coastal areas.

Since the earliest days of the Forest Service, which was founded in 1912, there have always been those both within and outside its ranks who saw its function as something more than simply a fire-fighting agency. The road toward a more comprehensive approach to forest management was long and tortuous, however, and fraught with many pitfalls. The dramatic and shattering impact on the public mind of tremendous annual devastation by fire did have the result of drawing general attention to the forests as a provincial and national asset of inestimable value. The Service, however, was generally restricted to a prevention, suppression, and timber-selling role with the broader aspects of forest management receiving little attention from the public.

However, dedicated foresters persisted and by the mid-1930's had found powerful allies who were shocked to discover that the seemingly endless resource was not endless at all. They were horrified to learn that, through forest fires, disease and insect attacks, improvident and wasteful logging practices, their mighty coastal forests were beginning to recede at a noticeable rate. The second world war with its natural and voracious appetite for timber from British Columbia brought the matter of forest conservation to a head. The result was a Royal Commission on Forestry, with the late Honourable Gordon McG. Sloan, Chief Justice of British Columbia, as the sole commissioner.

In 1945, the first Sloan Commission reported and the magic words "sustained-yield forestry" and "forest management" were first widely heard throughout the Province. Thus was heralded the ending of an era as a new and revolutionary plan started to develop.

In 1947, the British Columbia Forest Act was significantly amended to provide for the establishment

FIGURE 3. – *Artificial reforestation has been a major program in British Columbia since the mid-1930's. Four Forest Service nurseries supply planting stock to industry free of charge. Plantations are put in by both industrial and Forest Service crews. Nearly 170,000 denuded acres (63,000 hectares) have been planted so far.*

FIGURE 4. – *The forest development road program is a key instrument in bringing forest industry into balance and increasing accessible forest wealth for smaller operators. Standard of roads is demonstrated by such permanent, high-quality bridges as this one in the Chilliwack Sustained-Yield Unit.*

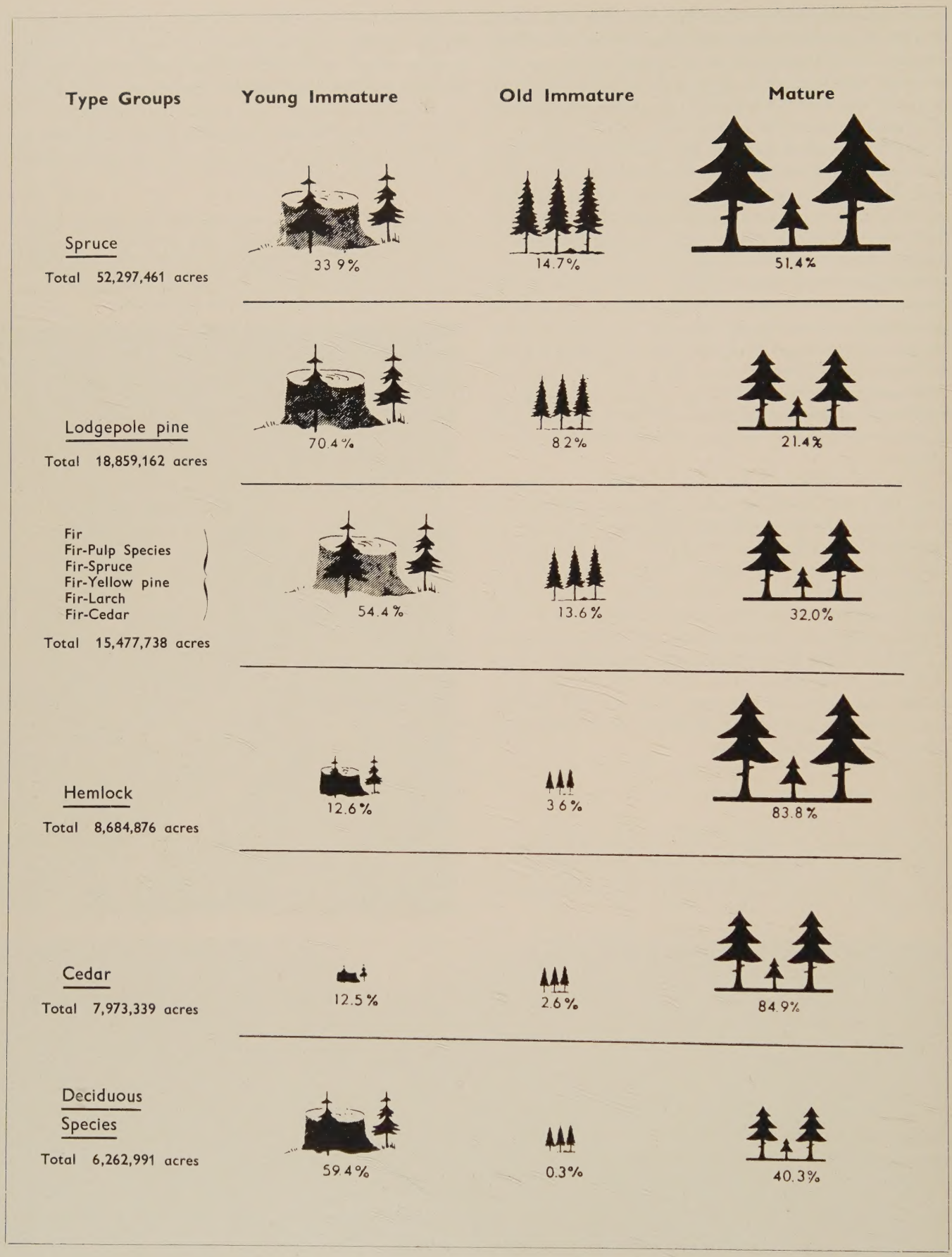

FIGURE 5. – *Type groups and age groups in forest areas of British Columbia. Based on commercial forests on productive sites, regardless of accessibility. Source:* Continuous Forest Inventory — Initial Phase — 1957. *Note that one acre = 0.4 hectare.*

of supervized but privately-operated sustained-yield units. By the following year, the first of these forest management licences, now called tree farm licences, was awarded to the Columbia Cellulose Company to operate in what was previously considered to be economically inaccessible stands in the Prince Rupert area, south-east of the Alaska Panhandle.

Today, there are 33 tree farm licences covering a total productive forest area of well over 5.5 million acres (2,226,000 hectares) with a total annual allowable cut of some 230,000,000 cubic feet (6,500,000 cubic meters) per year.

The basic philosophy behind the tree farm licences is to provide private industry with the opportunity to operate a long-term forestry tenure and benefit from long-term financing and integration, in return for the establishing of sustained-yield harvesting techniques under approved working plans over all the forest in the licence — be it privately held or Crown property. The contract comes up for general review every 20 years. There is, however, a constant exchange of information between the licensee and the Forest Service about cutting budgets and general silvicultural practices. The licencee is entirely responsible for forest protection and the cut must average his sustained-yield capacity over each 10-year period of operation.

The tree farm licence is attractive to the larger, integrated operation that can accept the heavy, long-term financial and forestry implications. There is, however, a most important part of the industry, referred to as "the little man". This term "little man" in the Coast sphere at least, is purely relative. It is not in any way unusual for the small, independent operator to have an investment of $500,000 or more in his business, and he plays a very important role in the forest economy. Something therefore, had to be done to give him an opportunity to continue operating.

With this in mind, Crown-operated sustained-yield units have been set up over the past decade. Under this form of tenure, the operator bids on timber put up for sale within a government-operated sustained-yield unit. The amount cut from any such unit is determined by the Forest Service as is the method of harvesting.

Sustained-yield units make it possible for the smaller operator and the dependent local economy to benefit from a sustained-yield operation without requiring heavy capital investment.

By the end of 1958, there were 61 sustained-yield units in operation throughout the Province, covering 32,389,900 acres (13,108,200 hectares) of productive forest land with an annual allowable cut of 380,000,000 cubic feet (10,750,000 cubic meters). In addition to these two major forms of sustained-yield tenure, there are the smaller certified tree farms and farm woodlot licences, the latter available to *bona fide* farmers only. The current annual sustained-yield capacity of tree farm licences and sustained-yield units amounts to some 600,000,000 cubic feet (17,000,000 cubic meters) or 66 percent of the total provincial cut for 1958 from all forms of forest tenures.

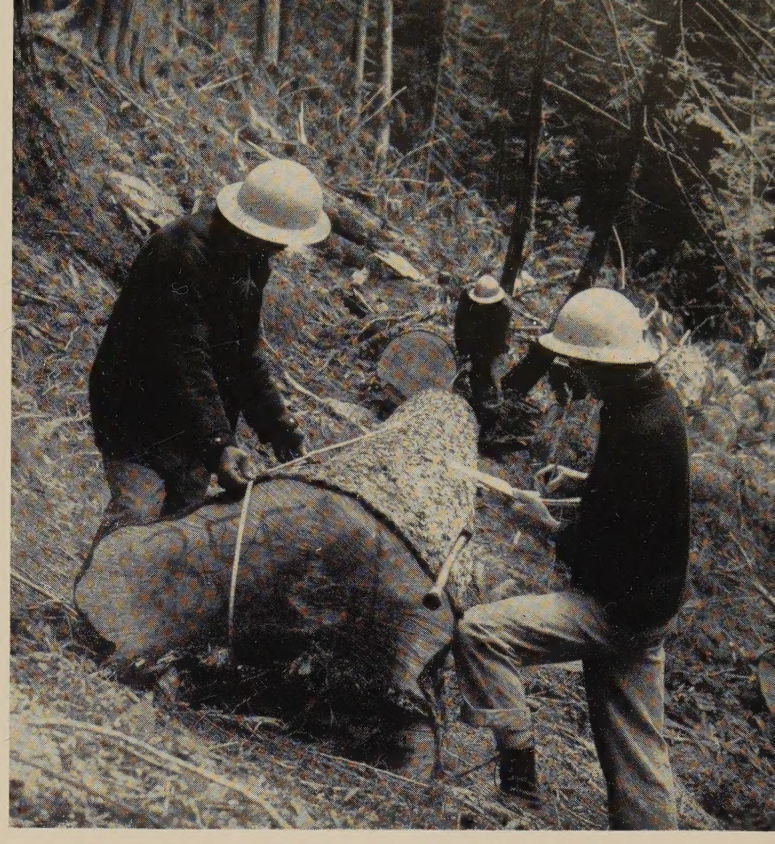

FIGURE 6. – *Canada's Pacific province of British Columbia completed in 1957 the initial phase of its new forest inventory under the Canada Forestry Act, after seven years of field work. For the first time the province had a reasonably accurate inventory basis upon which to build its sustained yield program.*

FIGURE 7. – *Forest fires occurrence and lack of access continue as British Columbia's largest single problem. In 1958, 4,120 fires were reported. They burned over 2,000,000 acres (809,400 hectares). This was the worst fire year in British Columbia's history. Here a 858 Sikorsky carries fire-fighting supplies in to a 30,000 acre (12,141 hectares) blaze north of Prince George.*

The administrator of the forests of British Columbia is concerned not only with the maintenance of the industry in a vigorous and healthy state but must also be keenly aware of the effect such a massive industry has had, is having, and is likely to have, on the welfare of the prime resource itself.

Forest Management

The first and essential step towards the comprehensive planning of forest management is to obtain as accurate and complete an inventory as possible related to the utilization standards of the day. Since early in the history of the Forest Service, the work of forest inventory was carried on. Due to lack of funds and personnel, these early attempts, though worthwhile, did not provide sufficient information for a base for sustained-yield planning. In 1951, however, the Service was able to benefit from the Canada Forestry Act and its federal-provincial agreement for forest inventory. Considerable federal financial aid became available to the Province if it would undertake to produce forest statistics to a rigid standard suitable for inclusion in national totals. The initial phase of the survey was completed two years ago and resulted in the publication of the report, *Continuous Forest Inventory of British Columbia – Initial Phase, 1957*. For the first time, British Columbia had an accurate assessment of her forest resource. The Surveys and Inventory Division still operating under an extension of the original federal agreement, is engaged in its second year of a 10-year maintenance cycle.

Accessibility

As the dimension of the resource was realistically determined, the next problem to overcome was the matter of accessibility. Accessibility has always been a tremendous problem in British Columbia because of its size, its rugged topography, and the limited funds available for forest development. In the matter of forest management, the key factor of accessibility is always present. Accessibility is not only related to topography and physical availability of markets, but also to market prices — in British Columbia's case, export prices — themselves.

In the case of the tree farm licence, the problem of accessibility is, to a large extent, shifted to the licensee once he accepts the design of his contract. In the case of the sustained-yield units, however, it was obvious that something had to be done to make these forests economically accessible to the smaller operator. Otherwise, he was no better off than before.

The forest development road program thus came into being. This road system through the sustained-yield units is designed to make available previously inaccessible stands. Roads are designed and located to various standards according to the volume of timber and the quality of the site in each part of the forest in conjunction with the most efficient utilization plan. Forest development roads are haul roads (adverse grades are designed on the basis of hauling cost and construction cost) for the use of experienced drivers. They are constructed as permanent roads for a definite traffic volume which will increase very little. The capital cost is amortized over an economic period comparable to that used by industry to determine the feasibility of each project. The amortization charge is computed on the unit of measurement of the forest products to be hauled.

Since 1950, the Engineering Services Division of the Forest Service has completed construction of well over 200 miles (320 kilometers) of forest development road, has located another 475 miles (764 kilometers) and carried out reconnaissance on 1,539 miles (2,476 kilometers) of possible routes.

Through this road program, vast previously inaccessible forest areas are being brought into the accessible sphere and the smaller independent operator can continue as a key member of the vast forest industries of British Columbia. In addition, the imbalance of the forest cut is, to a heartening degree, being corrected. Until only five years ago, almost 80 percent of the provincial cut originated from the lower coastal area where regional overcutting was prevalent. Today, 56 percent of the provincial cut originates here and the remainder comes from the previously undercut inferior regions.

Thus, in a general way, the first steps have been made towards putting every forested acre in British Columbia under some system of sustained-yield management, which is the ultimate aim of the Forest Service.

If this is the general picture, it is only a reflection of specific progress in many fields — research, reforestation, silvicultural treatment of stands and so forth.

Artificial reforestation has been a major policy of the Service since the mid-1930's. Four nurseries are in operation — three on the coast producing two-year-old Douglas fir planting stock, and one in the interior specializing in yellow pine. In addition, experimental nurseries have been set up in the spruce-balsam forests of north-central British Columbia. If these prove successful, artificial reforestion will play an important role in coping with the regeneration problem in the northern stands.

Genetics

Planting stock from Forest Service nurseries is made available, on request, to industry at no charge. The tree farm licence holders are making good use of these facilities in order to keep their licences fully productive. Planting on industrial land is either done by company crews using Forest Service stock or, if requested, by Service crews. In the latter event, the costs of planting are charged back to the company concerned (Table 4).

Considerable work in genetics is being carried out by the Research and Reforestation Divisions of the Service and a special industrial committee in connection

with the production of selected strains of Douglas fir to be planted in seed orchards. This is all part of a general seed-improvement program now in its initial stages.

Forest fire suppression

If there is one single problem of forest management that has always overshadowed the others in British Columbia it has been, and still is, forest fire suppression. Last year was the most devastating fire season on record. A total of 4,120 fires were reported. They burned over two million acres (809,400 hectares) and killed 1,472,882,000 board feet (3,476,000 cubic meters) of accessible, merchantable timber. Forest Service fire-fighting costs amounted to $4,500,000 and the industry spent one million dollars on fire suppression.

The heaviest costs of suppression were attributable to the lightning-caused fires. These cost 75 percent of the total expenditure although they accounted for only 28 percent of the total number. Here, again, is the old problem of accessibility underlined with a vengeance (Table 5).

Every available type of fire-fighting equipment was used during the season. Fixed wing aircraft and helicopters saw continuous action in carrying crews and equipment and both types were used in bombing fires with water and sodium calcium borate.

If it ever needed proving; the 1958 fire season proved conclusively that men on the fire-line are still the final answer to suppression. Lack of accessibility is the massive problem in the Province's fire suppression program. Over 200 miles (320 kilometers) of new forest protection roads were constructed last season, to add

TABLE 4. – SUMMARY OF PLANTING DURING THE YEARS 1949 TO 1958

Year	Experimental		Forest Service on Crown land		Private companies		Community forests		Private plantings and farm woodlots		Total	
	Trees, in thousands	Acres	Trees, in thousands	Acres	Trees, in thousands	Acres	Trees, in thousands	Acres	Trees, in thousands	Acres	Trees, in thousands	Acres
Coast												
1958	24.6	20.0	855.8	1,051.0	7,062.8	[1] 13,410.0	38.0	62.0	67.0	67.0	8,048.2	14,610.0
1957	11.7	14.0	294.0	435.0	2,992.5	7,524.0	8.0	10.0	21.4	30.0	3,327.6	8,013.0
1956	30.6	29.0	954.3	1,682.0	1,428.7	3,536.0	1.2	2.0	58.7	90.0	2,473.5	5,339.0
1955	10.0	15.0	2,174.6	3,410.0	4,623.4	7,076.0	40.0	15.0	62.2	80.0	6,910.2	10,596.0
1954	27.5	30.0	5,679.0	7,135.0	3,302.0	5,024.0	59.5	36.0	73.7	72.0	9,141.7	12,297.0
1953	28.5	33.0	2,377.0	2,860.0	2,740.1	3,808.0	25.0	31.0	21.0	6.0	5,191.6	6,738.0
1952	8.1	5.0	4,228.4	4,865.0	1,664.2	2,065.0	137.4	210.0	40.9	15.0	6,079.0	7,160.0
1951	12.0	20.0	5,733.9	6,070.0	1,808.0	2,235.0	110.0	130.0	31.2	25.0	7,695.1	8,480.0
1950	—	—	6,261.6	6,670.0	553.1	680.0	52.0	50.0	20.9	—	6,887.6	7,400.0
1949	15.3	15.0	7,418.5	8,125.0	855.5	1,010.0	5.0	—	23.2	15.0	8,317.5	9,165.0
Previously planted	713.4	621.7	49,345.0	62,145.0	8,707.8	10,906.3	304.0	322.0	134.9	122.0	59,205.1	74,117.0
TOTAL to-date	*881.7*	*802.7*	*85,322.1*	*104,448.0*	*35,738.1*	*57,274.3*	*780.1*	*868.0*	*555.1*	*522.0*	*123,277.1*	*163,915.0*
Interior												
1958	3.8	5.4	471.4	592.0	70.7	111.0	—	—	2.4	2.4	548.3	710.8
1957	31.1	42.0	137.9	179.0	88.8	114.0	20.0	30.0	16.6	17.0	294.4	382.0
1956	34.7	46.0	192.1	259.0	121.4	192.0	—	—	16.3	10.0	364.5	507.0
1955	1.5	2.0	215.8	288.0	81.0	105.0	—	—	12.2	10.0	310.5	405.0
1954	5.6	8.0	590.9	1,007.0	94.0	109.0	—	—	7.2	9.0	697.7	1,133.0
1953	2.0	2.0	282.3	284.0	35.0	47.0	—	—	10.4	17.0	329.7	350.0
1952	27.0	38.0	167.2	292.0	2.0	—	—	—	3.1	4.0	199.3	334.0
1951	56.5	78.0	0.2	—	—	—	0.5	—	1.2	1.0	58.4	79.0
1950	27.2	30.0	—	—	—	—	—	—	0.1	—	27.3	30.0
TOTAL to-date	*189.4*	*251.4*	*2,057.8*	*2,901.0*	*492.9*	*678.0*	*20.5*	*30.0*	*69.5*	*70.4*	*2,830.1*	*3,930.8*
All planted to-date	*1,071.1*	*1,054.1*	*87,379.9*	*107,349.0*	*36,231.0*	*57,952.3*	*800.6*	*898.0*	*624.6*	*592.4*	*126,107.2*	*167,845.8*
All planted this year	28.4	25.4	1,327.2	1,643.0	7,133.5	13,521.0	38.0	62.0	69.4	69.4	8,596.5	15,320.8

[1] The Forest Service planted 1,899,000 trees on 2,128 acres of private lands under reforestation agreements (Forest Act, section 166).

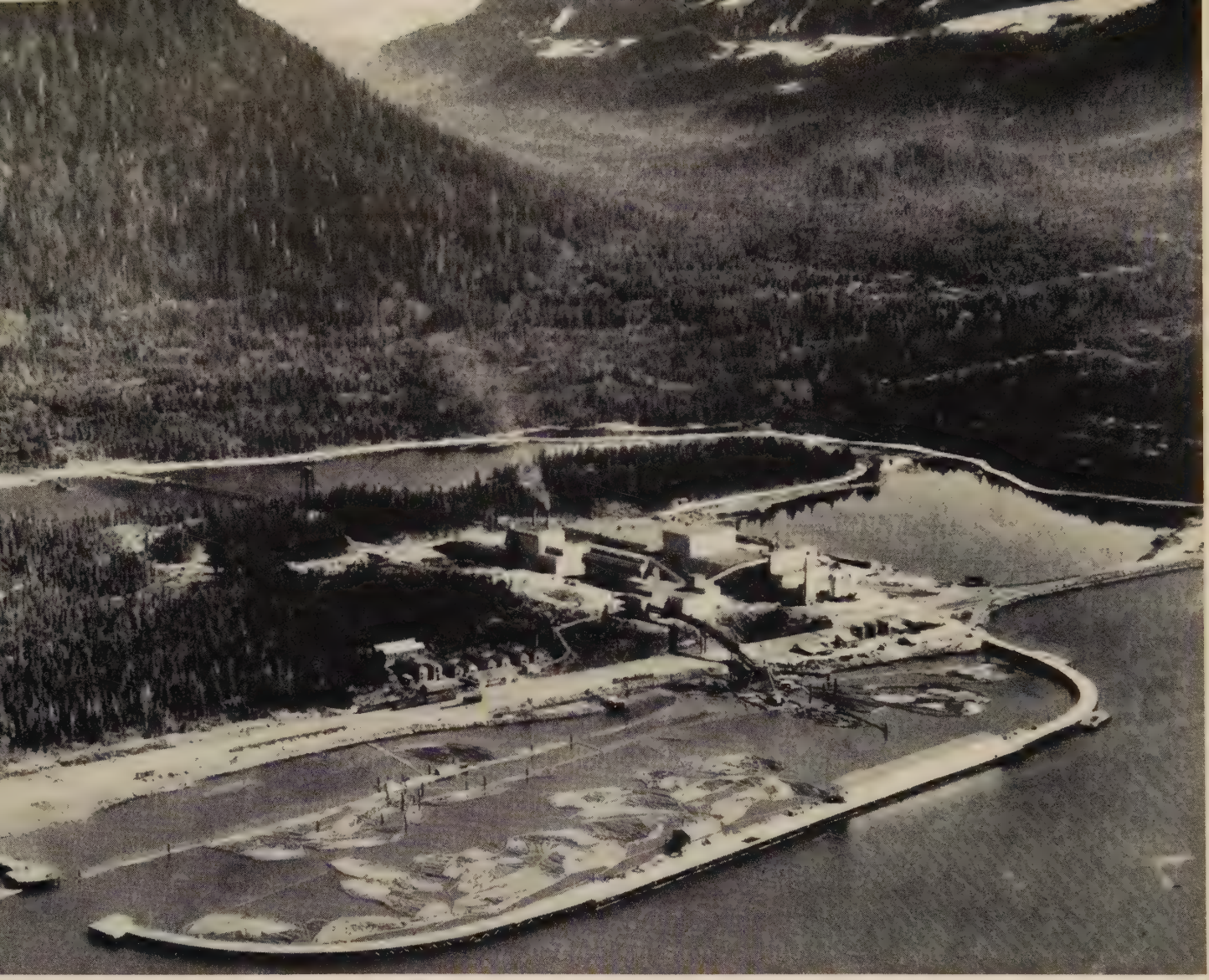

FIGURE 8. – *Such massive, well-integrated operations as this Columbia Cellulose Mill near Prince Rupert have become a reality for British Columbia as a result of the securing of log supplies through tree farm licence operations.*

TABLE 5. – FIRE CAUSES, AREA BURNED, FOREST SERVICE COST, AND TOTAL DAMAGE, 1958

Causes	Fire causes		Area burned		Forest Service cost		Total damage	
	Number	Percent	Acres	Percent	Cost	Percent	Damage	Percent
Lightning	1,150	27.9	888,673	43.0	$3,416,135	75.4	$6,424,084	77.2
Campers	296	7.2	931,226	45.1	110,098	2.4	481,135	5.8
Railways operating	1,224	29.7	5,235	0.3	78,959	1.8	56,166	0.7
Smokers	478	11.6	19,896	1.0	323,426	7.1	197,881	2.4
Brush-burning (not railway-clearing)	120	2.9	17,992	0.9	8,996	0.2	43,803	0.5
Road and power- and telephone-line construction	18	0.4	43,847	2.1	21,943	0.5	39,013	0.5
Industrial operations	246	6.0	25,706	1.2	155,808	3.4	498,513	6.0
Incendiarism	53	1.3	15,180	0.7	216,585	4.8	178,009	2.1
Miscellaneous (known causes)	441	10.7	105,545	5.1	185,336	4.1	386,967	4.6
Unknown causes	94	2.3	12,123	0.6	10,851	0.3	19,847	0.2
TOTALS	4,120	100.0	2,065,423	100.0	$4,528,137	100.0	$8,325,418	100.0

to the 850 miles (1,368 kilometers) being maintained, but it is still only a " drop in the bucket ".

Every possible effort is being made, within the limits of funds and staff available, to improve fire suppression effectiveness. The forest industries have shown a high degree of co-operation and are of great assistance, particularly in the southern coastal areas. The sustained-yield program, insofar as tree farm licences are concerned, has done much to relieve the Forest Service of a part of its protection burden in this area. The continued development of Crown-operated sustained-yield units, with their growing network of good quality roads, will gradually increase accessibility for suppression purposes.

It is going to be a long haul, however, before this problem is even partially solved. But we are confident that, in due course, if steady progress is maintained, our suppression forces and facilities will be up to the task.

It is our hope that this protracted period may be greatly shortened by increased federal assistance for more forest protection and more forest access roads under the Canada Forestry Act. When this assistance is proportionate to that contributed to state forestry by the United States Government under the Clark McNary Act, we shall be a long way towards our goal.

It is true that no-one with any conception of the forest situation in British Columbia could possibly feel that the sustained-yield job is nearly finished. Far from it — we have only begun. And yet that beginning, no matter how small, is to us a tremendous landmark of achievement. We take heart in the fact that over the last seven years more has been done towards securing the forest future of the Province than in all its previous history.

FIGURE 9. – *Considerable work in genetics is being carried out in British Columbia by both Government and industry directed towards the production of selected strains of Douglas fir.*

Automation in Medium and Small Sawmills

Milton H. Mater
President, Mater Machine Works Inc., Corvallis, Oregon, United States of America

Automation of sawmill operations has awakened much interest among sawmill operators in recent years because it has made an outstanding record in reducing manufacturing costs in such industries as steel, aluminum, plastics and concrete blocks. Can automation be applied as successfully to reducing manufacturing costs in sawmills?

Till recently many sawmill operators believed that automation is so complicated and requires such large capital investment that it can only be applied to very large sawmills. However, the recent development of sawmill automation machinery "packages" has simplified automation and made the investment practical for small- and medium-sized mills.

In many places today one sees mills in this category installing automation log decks, automatic log carriages, automatic edgers, trimmers and similar equipment at a reasonable investment in comparison to gains achieved.

Many sawmill operators have also believed that the single purpose of sawmill automation is to reduce the number of laborers required in the sawmill. Therefore, where the labor costs are low there appears to be little incentive for automating a sawmill. However, the reduction of labor is only one of the many gains made by automation.

Sawmill Automation: What It Is

Sawmill automation can be defined, for practical purposes, as the control of machines by other machines. For example, if two men are rolling logs on to a log deck and then onto the carriage, it is manual labor. If these men are replaced with a live chain deck, a log stop and loader, and a log turner, and only one man is used on the deck who pushes buttons to control the flow of logs to the carriage, it is mechanization. But, if a machine is installed to control the live deck and stop and loader, so that the logs move towards the carriage automatically, replacing the man who pushed the buttons, it is automation.

Mechanization and automation do not consist merely of installing new machinery. Often new machinery is not required. Mechanization and automation are new ways of thinking. Installing new machinery in a mill does not necessarily save labor or increase efficiency. For instance, if a mill has an old, two-man carriage using a dogger and setter, and if it is replaced with a new two-man carriage, the mill may save maintenance money and manufacture better lumber, but neither productivity nor efficiency will necessarily be increased.

Achievements of Sawmill Automation

Automation is applied with greatest financial gain in areas where labor costs are highest. The comparison in Table 1, based on American western rates, illustrates this.

Table 1. – Comparative Costs, etc., of Automated and Conventional Sawmills: United States

Costs, etc.	Automated mill A	Conventional mill B
Capital investment	$260,000	$150,000
Depreciation/year on a ten year basis	$ 26,000	$ 15,000
Number of men on the mill floor	5	10
Direct labor cost/year at $5,000/man	$ 25,000	$ 50,000
Total cost/year, Depreciation labor	$ 51,000	$ 65,000
Cost/thousand, based on 12 million board feet/year production	$ 4.25	$ 5.42

The automated sawmill operates at $14,000 less per year than the conventional mill. It can operate and show a profit when the other mill breaks even or shows a loss. The productivity (the number of board feet produced per man per day) of mill A is 10,000 per man per shift, in mill B it is 5,000 per man per shift.

There are many other gains to be made in applying automation to sawmills. Where manpower is used to load the logs in the mill, roll them onto the carriage turn the logs, dog, taper, set out, etc., the entire sawmill must be attuned to the limiting speed and strength of the human muscle. Where machines are used for the physical labor, the men who are placed in the control positions in the modern sawmill — i.e., sawyer, edgerman, trimmerman — can concentrate on making decisions based on their observations and judgment. Meanwhile, the machines do the actual handling and measurement much more accurately and faster than a human being can.

Automation also increases production. In most instances, when men are replaced by machines, not only does the production per man go up, but the total production of the plant increases. As a typical example, when a man was taken off the log carriage at a large western

United States mill, the manager reported that within two weeks his production on this headrig jumped from 38,000 per shift to 40,000 per shift. And this increase was made with one man less on his payroll!

Automation also makes for better, more uniform quality. Dimensional quality is more uniform with automation because it depends on repetition, and repetition is something a man does not do well. Setting dimensions accurately demands a man's full attention, both mentally and physically. This is tiring, and the momentary inattentions which occur are wasteful in variations of thickness, width or length. Again, a machine which is steel and copper and electricity and compressed air, cannot be lulled by repetition.

Automation permits dimensional quality control. If a machine is setting too thick, it can be adjusted. Automation eliminates the need for the unskilled type of laborer who merely handle logs or pieces. By replacing these unskilled men with machinery, we limit the type of men employed in the operation to highly skilled, high quality men.

Factors to be Considered in the Automation of Existing Sawmills

While the simplest method of sawmill automation would appear to be to scrap existing sawmills and start anew, it is obviously impractical to do this. Step-by-step progressive automation has been found to be the practical solution. To shut down and rebuild a sawmill for complete automation operation is usually prohibitive in terms of both time and money.

But a yearly allocation of money for sawmill improvement to be made during an annual shut down is practical and makes good business sense. Step-by-step automation makes sense also because many of the packaged automation machines are being developed gradually for stepwise automation of the mill.

It is important to realize that new machinery, or converting old machinery, is not always the road to automation. Sometimes an inexpensive reshuffling of the existing machinery, or the addition of a few limit switches can replace a man with a machine and improve productivity. Sometimes a combination of one or two new, improved machines, plus a reshuffling of existing equipment and the addition of a few limit switches, gives spectacular improvements.

One mill was able to increase the productivity by 50 percent, take seven men out of the sawmill, and save sufficient space for the addition of a green chain and lumber storage area by changing the line of its lumber flow, reshuffling positions, and adding only two new pieces of equipment, a riderless carriage and an automatic trimmer.

Automation of the front end of an existing mill can readily be accomplished. Packaged machines which can be installed in any mill have been developed for handling logs, from the log pond or dry deck, through the headrig. The modern automated mill does not have a man on the log haul or log deck. The first man usually found in the automated mill is the sawyer, who — by means of remote control — controls those deck functions which require his decision, i.e., log turning for grade carriage loading. All other functions, such as loading the logs onto the log deck, and the actions of the log stop and loader, are performed by automation.

The back end of the sawmill is more difficult to automate in an existing mill. The major difficulty is the lack of adequate waste clearing conveyors. In many existing mills the cost of constructing conveyors is so high that complete automation is not feasible and men must be used just to handle waste material.

Even without new or expensive machinery much efficiency can be gained by following, where possible, the concept of the self-cleaning mill. The general rule applying to automating the back end is: separate the waste material from the lumber pieces as soon as possible. Modern sawmill design calls for leaving the floor under all lumber-carrying rolls and transfers open, so that sawdust and other waste material can fall through into conveyors. In rebuilding a mill for automation it is often possible to follow this practice.

Sawmill Automation Equipment for Medium and Small Sawmills

Packaged equipment for automating medium and small sawmills has been developed in recent years, particularly for the front or headrig end of the mill.

Log decks

Logs are heavy and very often awkward to handle. Rolling these logs onto the carriage, dogging them, tapering the log and setting the log forward into the sawline all take a good deal of time and manpower. The process of turning the log after sawing off several pieces and opening a "face", so that a new "face" can be opened, is also a laborious, dangerous, and time-consuming job.

In modern sawmills, the function of handling logs is performed with electric motors and machinery and without manpower. Log turners are made in a sufficient variety of types and sizes that they can be installed in almost any sawmill log deck.

The mechanized log deck for carrying the logs to the carriage is often referred to as the "live deck". It consists of a set of horizontal skids on each of which rides an endless chain. A log stop-and-loader at the carriage end of the deck actually delivers the log to the carriage when the sawyer presses a button. The deck can be automated to roll logs forward automatically as they are required at the carriage.

When a pond is necessary, several varieties of log haul are available which automatically deliver the logs to the log deck.

Log carriage and headrig

The log carriage is equipment which can most readily be automated in most mills — often it is not even necessary to obtain a new carriage. Old carriages in good condition can be automated by attaching packaged conversion kits.

In the automation log carriage, the log is held to the carriage knees by means of compressed air operated dogs. These may be purchased as a " conversion kit " in a steel case which can be attached to the existing knees of most carriages. Different sizes of dogs are available for large, medium or small logs. The dogs operate much more positively and more powerfully than the men which they eliminate.

Setting out is done by the sawyer by remote control from his usual position on the mill floor. He presses buttons for the thickness to be set out. An air, electric, or hydraulic motor on the carriage automatically sets out this thickness. It eliminates the need for a man on the carriage, and also eliminates human error in the thickness setting. These remote controlled setworks can be installed on most types of existing log carriages. Various types of remote controlled tapering devices are available. The latest device is a sliding clutch arrangement which is fitted into the setshaft and is remotely operated to permit one knee to be displaced forward or back with respect to the others.

Air cylinder activated cant kick-off bars and flippers are readily controlled from the sawyer's position.

The compressed air and electricity are carried to the carriage by means of a pair of overhead swinging arms known as a " pantograph ".

The bandmill and circular saw husk have undergone changes in recent years to adapt to sawmill automation. A bandmill engineered especially for sawmill automation is built so that the sawyer can control strain, tilt and upper guide positioning by pressing buttons in his kit. The automation bandmill is engineered for a built-in slat bed, a requirement for automation offbearing. The circular saw husk for use in automation is engineered for ready disposal of the waste material from the carriage.

Offbearer

The packaged automation offbearer can be utilized by mills with a waste conveyor from the headsaw, which runs the full length of the mill.

The automation offbearer uses a wide flat belt over the offbearing rolls, which bears away the slabs and pieces of lumber.

A gap is left between the headsaw and the offbear belt. Short slabs, and pieces which cannot bridge this gap fall through into the conveyor. If a circular saw is used, the sawhusk is left open also, so that all sawdust, bark, slivers, etc., fall into the conveyor. If a bandmill is used, then a steel slot bed carries this material off into the gap. Long slabs are carried off by the belt and may be disposed of by several different means.

Edger and edger receiving and outfeed systems

Transferring pieces from the offbear belt or roll-case to the edger feed table automatically is a comparatively simple matter. Lifting transfer chains are installed on skids connecting the offbear system with the edger table. (When an offbear belt is used, it is divided on either side of the transfer chains and extra belt pulleys are built into the system.) The transfer skids are usually raised by an air cylinder.

In high speed mills, automatic setworks are used to position the edger saws instead of the manual levers or handwheels. Automating the edger itself is simply a matter of using power drives to shift the saws, and then using electrical means to control the shifting. In the simplest case, that of a two-saw edger whose saws move toward or away from each other, the handwheel which causes the saw to shift is replaced by an electric motor with a powerful brake built into it. An electrical control unit consisting of cams and limit switches, causes the motor to move the saws to certain widths, such as 4, 5, 6, 8 inches (10, 13, 15, 20 centimeters) etc. The edgerman can override the control unit to obtain other widths. In more complicated edgers, a motor is used to move each saw.

Edger tailing (removing edgings and lumber from behind the machine) is a process that has been difficult to automate. The successful mechanical devices for this purpose are limited to two saw edgers or to two sided edgers which use only two saws acting together on each side. The type of automatic tailing which can be used in less specialized sawmills, must be built into the mill itself.

Trimming

Trimmers come in three varieties: a single saw trimmer cutting pieces on a rollcase as they are stopped by the trimmer operator; two saw trimmers cutting the length as the pieces pass through sidewise, and a multi-saw trimmer cutting to lengths and trimming out defects as the pieces pass through it. Each of these can be automated to reduce the manual labor necessary for trimming, speed up the operation, and give the trimmerman more time to observe the pieces and make decisions affecting the grade.

The two-saw trimmer is automated by motorizing the saw shifting mechanism. The saws can be moved toward or away from each other by a motor which is controlled by cams and limit switches. In a more advanced type, one saw remains stationary while the other saw moves; this permits the maintainance of a " zero lumber line " through the trimmer.

The multi-saw trimmer is automated by providing limit switches in the trim table which provide for automatic end trimming of the lumber.

Automating a single saw rollcase trimmer consists of providing automatic stops in the rollcase and activating the trim saw by an air or hydraulic cylinder.

As in the other automatic devices, waste conveyors which will carry away the trim ends and sawdust efficiently are essential to the functioning of an automated trimmer.

The lumber-sorting functions

Packaged equipment for automating the lumber sorting function is limited at the present time. Packaged " green chains " are available for lumber sorting by the

green chain method, in which the pieces are carried sidewise on a series of endless chains and are pulled lengthwise into lumber piles at right angles to the chain.

Endwise sorting is automated by the so-called " edge sorter ". Lumber is sorted into slots built on rotating rolls or a moving belt, which is raised 10 feet (3 meters) above the floor level. The lumber falls into the slot on one edge and rides lengthwise down the rolls. Each slot ends at its " pocket ", which is merely an open space at the side of the rollcase, sloped down to a set of skids on which the lumber falls. In general, the edge sorting has been used for light and short lumber, up to 16 or 20 feet, with comparatively few sorts, say up to 12.

Automatic stackers are also in a comparatively primitive state of development and are not generally found in any but the largest mills.

Automation Problems and Solutions

The principles applied in building an automation sawmill differ markedly from those used in building an older type of sawmill, geared to the limitation of human muscle and ability. An automation sawmill is not merely one with automation equipment but is engineered for the most efficient layout and flow of logs and lumber. Adequate and correctly built conveyors should be built in so that the mill will be " self-cleaning ". Many designs of automation mills are available and can be adapted to particular mill conditions.

Sawmills considering a program of progressive automation must consider several important factors:

1. Automation requires labor with a certain degree of skill and training. When installing automation equipment, provision should also be made at the same time to procure or train labor to handle this equipment.
2. Automation equipment requires good preventive maintenance. Provision should be made for maintenance of automation equipment at the time of its installation.
3. New ideas and equipment require a transition period. Defects need to be adjusted or mended. It is possible that production may fall short of quotas for a brief period during this transition. Management should prepare beforehand for the transition period in order to get the best co-operation from supervisors and labor.

But sawmill automation has increased the efficiency of sawmilling and enables management to make the greatest utilization of labor, time and raw materials. Progressive automation of sawmills is a satisfactory method for achieving these results.

Mangrove Silviculture

M. A. Huberman
Forestry and Forest Products Division, FAO

The following is a modified extract from the FAO Forestry and Forest Products Study, Tropical Silviculture. *It gives the highlights of the silviculture of mangrove forests, and deals with the occurrence; physical factors; silvical factors such as composition, succession, seed production, establishment, and stand development; silvicultural practice; and some suggestions as to future research.*

The mangrove forest is a community controlled primarily by edaphic factors. Such edaphic communities occur in great variety and varying importance throughout the tropics as successional stages in the development of, or in retrogression from, the major climax communities. Although these communities are the result of many soil factors, structure, composition, aeration, the mineral contents of surface and soil water and water movement, including changes in water levels, probably the most important and most widely distributed are caused by an extreme water regime. As a consequence, a number of forest communities have been recognized variously as riverain, riparian, gallery, varzea, periodic swamp, freshwater swamp, peaty swamp, beach, tidal, and mangrove forests.

For most areas, mangrove forests probably have a greater importance from an economic standpoint than the other edaphic communities listed above, forming in all world areas an important source of timber, fuel, posts, poles, tannin and other minor forest products. The effects of commercial exploitation are more marked and, as a result, these coastal forests are better known. Furthermore, though river swamp or other edaphic forests occupy vast areas in the tropical world and in some areas, as in Malaya and Indonesia, surpass mangrove forests in commercial importance, they have been on the whole less intensively exploited and studied, and included for the most part with other rain forest or deciduous forest in silvicultural discussions. The *Mora* and *Wallaba* communities of the Guianas are good examples. Mangrove, moreover, warrants detailed consideration not only because of its commercial importance but also in view of its widespread distribution in all three tropical world areas and the far greater amount of useful information now available on a world basis for this sharply differentiated and silviculturally interesting edaphic forest community.

The word " mangrove " covers two different concepts. In the first place, it denotes those species, numbering some 20 to 40, belonging to several unrelated families but possessing similar physiological characteristics and structural adaptations with similar habitat preferences. In the second sense, it means a complex of plant communities found as a belt of varying width along the tropical shores of sheltered creeks, lagoons, deltas and islands below high tide mark. These edaphic communities are the result of the constantly changing conditions brought about by river deposits, formation of sand bars, lagoons, temporary swamps caused by alterations in river channels, lake borders and drainage patterns, tidal movements of salty or brackish water, in estuaries as well as for considerable distances upstream, and even the effects of wave action along seacoasts on the deposition of silt, mud or sand. Although mangrove species may extend beyond the level of the highest tides, Schimper (1903) defined " mangrove " and " tidal forests ", which he regarded as synonymous, to include the whole formation below the hightide mark. The term is used here in this sense.

Occurrence

In coastal areas, chiefly on muddy, sheltered shores subject to periodic submersion, mangrove forests may occur in widths varying from a few hundred yards (100 meters) to as much as 12 or 15 miles (19 to 24 kilometers). These forests may be on coastal islands varying in size from a few acres or hectares to many square miles or kilometers, in lagoons between these islands and the coastline, as well as in strips reaching upstream for many miles inland. Distribution is world-wide and is usually considered as occurring in two zones. The eastern zone comprises the east African coast as well as the coasts of Pakistan, India, Burma, Malaya, Thailand and the islands down to Australia. The western zone includes the coasts of America and the Caribbean and of West Africa. Although in general the distribution of mangroves of the richest and most luxuriant growth and development agrees with that of rain forest, it extends far north and south of the equator, sometimes beyond the tropics, along coasts of which the inland climax vegetation may be anything from mixed deciduous to desert types. The northern limit of mangrove vegetation extends to south Japan, the Gulf of Aquaba in the Red Sea, Florida in North America and the Bermudas, while it reaches its southern limit in northern New Zealand, in Natal in Africa, and in southern Brazil (about 27° 30′) in South America.

Data on the extent of the mangrove formation are not available for many countries. A few figures, however, have been reported: for example, for the Sundarbans (Ganges and Brahmaputra deltas in West Bengal, India, and East Bengal, East Pakistan), 4 million acres (1,600,000 hectares); for Malaya, 320,000 to 380,000

acres (129,500 to 155,500 hectares); for Puerto Rico, over 16,000 acres (6,500 hectares); Fiji Islands, 45,000 to 50,000 acres (18,000 to 20,000 hectares); Kenya, 80,000 acres (32,500 hectares); Tanganyika, 210,000 acres (85,000 hectares); Belgian Congo, 50,000 acres (20,000 hectares); Zanzibar, 40,000 to 50,000 acres (15,000 to 20,000 hectares); and for Indonesia, between 125,000 and 250,000 acres (50,000 and 100,000 hectares). Aerial photographs of the coastal regions of the other countries concerned would undoubtedly reveal a very important acreage of potentially rich mangrove swamps.

Physical Factors

Under the extreme edaphic conditions indicated, the effect of climate is less marked and no special summary of such factors seems necessary other than to note the wide range under which the mangrove formation occurs. Although climatic effects are not marked, Stehlé (1945-46) notes that the intense rains of winter seasons, as in the Caribbean, may dilute the salinity of the brackish mud which halophilous mangroves prefer, thus affecting their distribution; while winds, blowing unfixed sand from nearby dunes, may help to fill in mangrove swamps and thus influence composition and development. On the other hand, habitat conditions relating to physical location and resulting soil and water conditions have very important and marked effects on composition, succession, and silviculture. Indeed, one of the most striking features of the typical mangrove habitat is that at any one place the level of the ground is not only gradually rising but is also slowly getting further away from the sea, as accretion seaward takes place owing to continuous deposition of silt brought down by rivers especially in high rainfall areas. In consequence, there are changes in the frequency and duration of submersion and the degree of salinity of the water, and in any one region a wide variation in these environmental factors is possible, as one proceeds from the newly deposited mud banks into the gradually rising interior high ground.

These factors are probably of much greater significance than soil qualities as such. For the most part, the soil in most marginal formations contains a high clay fraction, often compact, blue in color, with low organic matter content. In the newer deposits facing the sea, as well as in the river-borne silt on river banks, the soil is more friable; brownish-black in color, it contains some sand and an important percentage of organic materials. The best development of the mangrove type coincides with occurrence of deep, well-aerated soil, rich in organic matter and low in sand. Good development is also found where the soil is a stiff clay, overlaid with a thin horizon of silt and raw humus. In areas subject to regular tidal inundations, the subsoil is a raw blue clay; in the drier areas, sandy subsoil is usually found. Approximately the same description is given for mangrove areas in most parts of the eastern and western zones.

Silvical Factors

The habitat factors described, relating to peculiar and special location, have a marked effect also on silvical features. For the most part, the mangroves are composed of shrubs or trees forming a characteristic dense evergreen and seemingly impenetrable mass of low forest, ranging from three feet (1 meter) to a hundred or more feet (30 meters) in height. The formation is essentially alike in its physiognomy and ecological relationships in both eastern and western zones. Characteristic species have, for example, special physiological features and structural adaptation to withstand periodic flooding, salinity of the water and consequent "physiological dryness"; e.g., *Rhizophora* species have stilt roots, *Bruguiera* and *Heritiera* species have knee roots, while those of *Sonneratia*, *Xilocarpus*, *Avicennia* and *Armora* send up asparagus-like pointed pneumatophores. Typical species are also characterized by a general tendency toward vivipary. Nearly all have large buoyant fruits or seeds, and thick, dark green coriaceous leaves with xerophytic structure. As Richards (1952) notes, mangroves are probably the most remarkable of all examples among plants of strong resemblances in similar though widely separated environments.

Composition

The composition in both eastern and western zones is essentially similar. All of the genera of the western mangrove are found in the eastern area, though

Figure 1. – *Planting up blank areas with* Rhizophora mucronata *in mangrove forests* (*Malaya*).

Courtesy, Malayan Forest Service

Table 1. - Approximate Composition of Mangrove Formation for Pakistan, India, and Burma (Troup, 1921)

Species	Sind	Indian peninsula		Sundarbans	Chittagong	Burma	Andamans
	Indus delta	West coast	East coast				
Rhizophora mucronata	x	x	x	x	x	x	x
R. conjugata	x	x	–	–	x	x	x
Ceriops candolleana (= *C. tagal*)	x	x	–	x	–	–	x
C. roxburghiana	x	x	–	x	x	x	–
Kandelia rheedii	–	x	x	x	x	x	x
Bruguiera gymnorrhiza	x	x	x	x	x	x	x
B. eriopetala	–	x	–	–	–	–	–
B. caryophylloides (= *B. cylindrica*)	–	x	–	–	–	x	–
B. parviflora	–	–	–	x	–	x	x
Carapa obovata (= *Xylocarpus granatum*)	–	x	–	x	x	x	x
C. moluccensis (= *X. gangeticus* in Sundarbans)	–	–	–	x	–	–	x
Cynometra ramiflora	–	x	x	x	x	x	x
Lumnitzera racemosa (= *L. littorea*)	–	x	–	x	x	x	x
L. coccinea	–	–	–	–	–	x	x
Sonneratia acida (*S. caseolaris*)	x	x	x	x	x	x	x
S. apetala	–	x	–	x	x	x	–
S. alba	–	x	–	–	–	x	x
S. griffithii	–	–	–	–	–	x	–
Scyphiphora hydrophyllacea	–	–	x	–	–	–	x
Aegicera majus	x	x	x	x	x	x	x
Acanthus ilicifolius	–	x	–	x	x	x	–
Avicennia officinalis	–	x	x	x	x	x	x
Excaecaria agallocha	–	x	x	x	x	x	x
Nipa fruticans	–	–	–	x	x	x	x
Phoenix paludosa	–	–	–	x	x	x	x

all species are different. The formation reaches its greatest luxuriance and floristic richness in the wet tropics of the eastern zone, notably Malaya and the Sundarbans, though it is relatively poor in species as compared with most tropical floras. Its essential homogeneity is well illustrated by species lists for several of the countries in each zone, as set out below. For the eastern zone, Troup (1921) shows the approximate composition for Pakistan, India and Burma (Table 1).

In Indonesia, the following species have been reported: *Rhizophora mucronata, R. apiculata, Bruguiera gymnorrhiza, B. sexangula, B. parviflora, Ceriops tagal* (syn. *C. candolleana*), *Xylocarpus granatum, Sonneratia caseolaris.* In Malaya, the principal species are: *Rhizophora conjugata, R. mucronata, Bruguiera parviflora, B. cylindrica* (Syn. *B. caryphylloides*), *B. gymnorrhiza, B. hainesii, B. eriopetala* and *Ceriops tagal.*

For the western zone, lists of the composition of forests in Puerto Rico and Nigeria are available. In Puerto Rico, the four principal species are *Rhizophora mangle, Laguncularia racemosa, Conocarpus erecta* and *Avicennia nitida.* In Nigeria and the Belgian Congo, the mangrove forests consist of *Rhizophora racemosa* (about 99 percent), *Avicennia nitida, Laguncularia racemosa* and *Conocarpus erecta* (on the drier fringes of the swamps) and *Acrostichum aureum.*

One other outstanding feature of mangrove forests affecting composition is the zonation of different plant communities in strips more or less parallel to the shore line, with definite segregation of zonation of the dominant species. For example, in Malaya, the stands along the seaface are usually *Avicennia intermedia, A. alba* or *Sonneratia alba* with *Rhizophora* sp. on somewhat higher ground and *Bruguiera* behind, often continuing up to the extreme tidal limit of the swamps.

Succession

Succession, with some differences in pioneers, is essentially the same in both zones. Thus in Malaya, for example, mudbanks must be free from inundation for about two days a month before colonization takes place (above the neap-tide high-water mark). *Avicennia* species, of which *A. alba* is by far the commonest, are pio-

neers of the clay accretion areas out by the sea face, while *Sonneratia alba* is the typical pioneer of mud banks within the estuaries. *Avicennia* on the heavy sea-face clays is succeeded by *Bruguiera cylindrica*, as the ground level rapidly rises to extreme tidal levels. On the estuarine silts *Rhizophora mucronata* replaces *Sonneratia alba* but the soil level is not built up so quickly.

As the soil becomes better aerated and more humus is incorporated in it the maximum development of *Rhizophora* forest, principally *R. conjugata*, is found (sometimes called the " climax " of the mangrove succession). *Rhizophora* forest is distinctly poorer on heavy clay soils or soils subject to river flooding and sand deposition. Optimum inundation conditions are coverage by all normal high tides with dry periods of four to eight days twice each month at neap tides. It is estimated that more than two thirds of all Malayan mangroves consist of *Rhizophora* forests characterized by numerous small streams. Associated species are usually *Bruguiera parviflora* and the fern *Acrostichum speciosum* with locally *Xylocarpus granatum* and *Ceriops tagal*.

As the soil level rises and inundation is less common, other species of *Bruguiera* are able to establish themselves. These *Bruguiera* species, probably *B. gymnorrhiza*, *B. hainesii* and *B. eriopetala*, become prominent as areas become drier forming the transition to the inland forms of tidal forests, representing the final stage in the succession. Although *Rhizophora* can grow up to the limits of tidal flooding, regeneration of these species, as well as those of *Bruguiera*, becomes uncertain. Here *Acrostichum aureum* grows densely and is undoubtedly a serious factor preventing the establishment of regeneration, and eventually the tidal forest species of *Xylocarpus*, *Heritiera*, *Intsia* and *Lumnitzera* (Watson, 1928).

This is essentially the progress of the succession in most mangrove areas of both the eastern and western zones, with only slight variations. In Nigeria, for example, *Laguncularia* shrubs grow on the newly formed banks at the mouths of creeks emptying into the sea. Inland from these are found *Avicennia* trees 16 feet (5 meters) in height, and then on the slimy soil *Rhizophora* can become established. Both *Avicennia* and *Rhizophora*, for reasons not clearly understood, can occur in stunted forms. On the edges of swamps, there are found such shrubs as species of *Hibiscus*, *Drepanocarpus* and *Ecastaphyllum;* herbs such as *Ipomea* and *Telanthera*. On the sand ridges behind *Avicennia* stands there are *Xylocarpus* (syn. *Carapa*), *Cathormion*, *Phoenix reclinata*, *Raphia* and *Elaeis*. Where fresh water from streams floods the area *Mitragyna ciliata* occurs; and in the final stages of dwarf *Rhizophora* the fern *Acrostichum* is found.

In spite of striking similarities, however, it is not to be assumed that all mangrove forests will pass through the whole sequence of development and that all the types are present. In this connection, the importance of the study of local variations in the succession in relation to the silvicultural treatment and management of mangrove forests, as caused by the interaction of such factors as frequency of submersion, salinity, the nature of substratum, and the erosive or aggressive action of the sea, cannot be too strongly emphasized.

Holdridge (1940) reports the following changes in composition after cutting:

Species	Present-day percentage	Percentage before human intervention
Laguncularia	50	30
Avicennia	25	30
Rhizophora	20	30
Conocarpus	5	10
	100	100

Indeed, final felling often seems to cause crop deterioration by delaying succession in the early stages, hastening it in the latter stages or encouraging inferior species in the climax stage. Efforts to speed up succession by cutting pioneer *Avicennia* species seem to bring about prolific regeneration and coppicing, due to the removal of shade to which they are highly intolerant. On the other hand, in the drier areas, felling may encourage the invasion of *Bruguiera* into *Rhizophora* stands; and in the driest areas *Acrostichum aureum* seems to grow densely after felling and may prevent re-establishment of mangrove forest. The entire question of succession following opening up of mangrove forests needs further study.

Seed production and establishment

Seed production is annual and abundant to prolific, with seeds viviparous or otherwise, of high germinability and capable of remaining viable for long periods. *Rhizophora* and *Bruguiera* are viviparous, germinating before falling, *Avicennia* semi-viviparous, others not. ' Seeds ' are usually water-borne. Natural layering is reported with *Laguncularia*, and sprouting common with *Avicennia* and *Rhizophoraceae*, though only with young seedlings with the latter genera (Stehlé, 1945-46; Noakes, 1954). Some mangrove species coppice well, particularly in their youth.

Germination and rooting are usually rapid and successful with all important species. The common mangrove species, with a few exceptions, are strongly light-demanding and the natural forest canopy over much of its life is dense and even, with only a sparse undergrowth beneath. The closeness of the canopy inhibits the survival of seedlings of desired species. The most important exceptions in the Malayan area are *Bruguiera parviflora* and *B. gymnorrhiza*, both of which are considered undesirable, though the latter is a commercial species of importance in the Andamans (Banerji, 1954). However, as the canopy thins with age or treatment, natural regeneration is almost always present in Malayan areas and in the Sundarbans, though reported as less certain over

FIGURE 2. – *Natural regeneration of* Rhizophora mangle *in open spot of stand. Mangroves of Central American region.*

Courtesy, O. Jurgenson

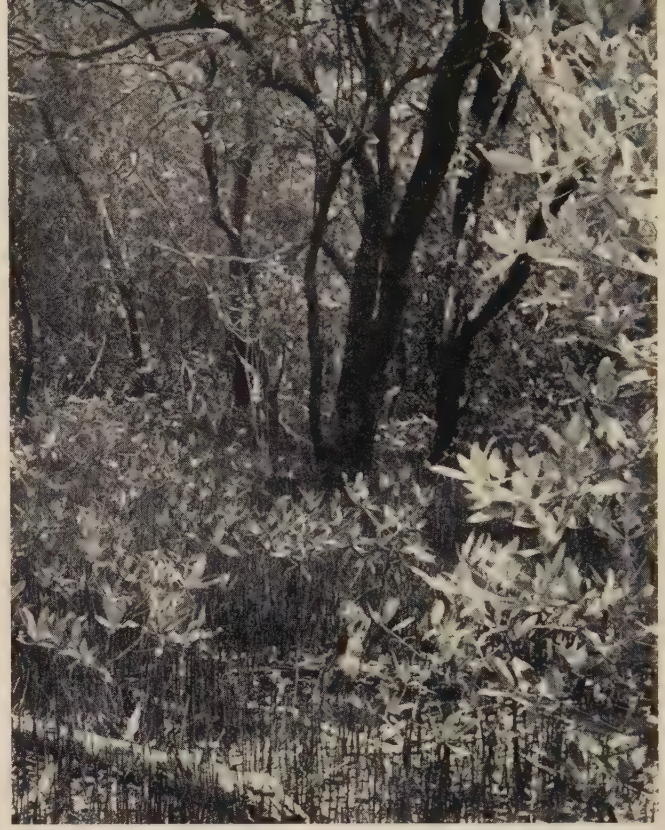

FIGURE 3. – *Natural regeneration of* Avicennia nitida *and* Rhizophora mangle. *Mangrove stand of Central American region composed chiefly of* Avicennia nitida.

Courtesy, O Jurgenson

most of the western zone. Though much regeneration often appears to be almost completely destroyed with removal of the overwood, full natural stocking is ordinarily obtained. Abundant natural regeneration is not a problem in most mangrove forests.

In some places, as in Puerto Rico, the salt content may be so high in extensive areas known as " salitrals ", that the sun produces a brilliant reflection from the salt crystals. This condition discourages the establishment of natural regeneration unless rain, or fresh water from streams, dilutes the salt. Studies in Puerto Rico have shown also that the size of canopy openings, as well as other factors, may determine whether regeneration will be of the desired species. Water levels appear to play an important role in the determination of such establishment but the exact reasons are not clearly understood.

In some locations, when the seeds are able to settle as a result of favorable water conditions, natural regeneration may become successfully established in less than a year. Normal high tides may cover only part of the surface, while the combination of very high tides in September and October, which usually cover large areas, combined with abundant seed fall, may result in excellent regeneration. The movement of the water, however, may not only bring in seeds but may also carry them away before they can take root. Ordinarily, during periods of normal tide, there are many lagoons and shallow pools but these are not always the sites of good establishment. Various reasons have been offered for this: the high temperature of the water due to insolation, or the salt concentration may be high enough to be toxic to the young seedlings. Planting in such areas has been successful with *Rhizophora* but not with other mangrove species.

A few other factors also tend to retard or prevent proper regeneration. In Malaya, monkeys may cause minor damage by uprooting seedlings, particularly in plantations; and crabs may be so serious as to prevent completely natural regeneration and even planting as a result of their attacks on the seedlings. In large openings, the fern *Acrostichum aureum* finds conditions excellent for growth and may take over extensive areas. The fronds may grow to heights of 6 to 12 feet (1.8 to 3.7 meters) and the large masses of rhizomes and roots and the dead and fallen fronds may interfere with the settling of germinating seedlings, though this fern may also protect established seedlings from damage from falling branches and the movement of floating logging debris, often detrimental to the initial establishment of waterborne seeds. In the western zone, the encroachment on drier areas of the giant *A. aureum* may be serious enough to require burning the ferns during the drier months of January to April, followed by two cuttings with machetes several months apart, to prepare the areas for planting or for natural seeding during the high tides in September-October.

The logging debris may be sufficiently voluminous to prevent the establishment of natural regeneration or to do considerable damage to established seedlings, as such debris floats with the tide. Under Malayan conditions, control of such logging slash by burning has

proved impossible. The utilization of as much of the logging material as practicable, perhaps for charcoal where economic conditions permit, may provide a partial answer.

Deep inundations for considerable distances up rivers and creeks and the speed of the receding waters often prevent the seedlings from becoming established naturally; and, in fact, such high tides may sweep away established plantations. Human trespass in heavily populated districts is also a serious problem.

Stand development

Once established, the principal mangrove species grow well, forming straight, clear, cylindrical, sometimes multiple boles with few side branches, and compact crowns. In closed forests, *Rhizophora* produces straight trunks with compact crowns, and may grow to heights of 70 to 120 feet (21 to 37 meters) with girths of 3 to 7 feet (1 to 2 meters). In Malaya, for example, the normal felling size at the age of 20 to 30 years is 50 to 60 feet (15 to 18 meters) in height and 18 to 30 inches (46 to 76 centimeters) in girth. In Puerto Rico, the sizes are somewhat smaller and data in one area showed a count of more than 17,000 stems of *Laguncularia* per acre (43,500 per hectare), of which 60 percent were less than ½ inch (1.3 centimeters) in diameter and the largest stem was only 3.7 inches (9.4 centimeters).

FIGURE 4. – *Young stand of* Laguncularia racemosa *reproduced from natural regeneration. Mangroves of Central American region. Observe good form of stems.*

Courtesy, O. Jurgenson

With regard to growth and yield management plans in the eastern zone countries, such as in Malaya and in the Sundarbans, present preliminary data on the mean annual increment as a guide to rotations and cutting cycles. The mean annual increment of mixed *Rhizophora* forest in Malaya, for instance, culminates at 25 years, making allowance for a three-year regeneration period. A yield table which has been tentatively compiled for the best mangrove forest in Malaya, in Perak, shows a culminating mean annual increment of 130 to 140 cubic feet per acre (9 to 10 cubic meters per hectare) with a final yield of about 3,000 cubic feet per acre (210 cubic meters per hectare). The average mangrove forest in Malaya, however, does not yield as much.

In the case of *Bruguiera cylindrica*, measurements indicate that this slow-growing species may require at least 40 years to reach commercial size. Actual harvesting yields for this species are not available; similar data from other localities are rather fragmentary. Troup (1921) reports one locality in the Arakan (Burma) as having produced 25 tons per acre (63 metric tons per hectare) of wood and 3 tons per acre (8 metric tons per hectare) of bark at maturity. Management plans in the western zone have not been developed to the point where reliable yield figures are available.

Cleanings and weedings are rarely needed, though thinnings may be carried out if there is a market for the stems. Thinnings are usually by the ' stick ' method, i.e., to uniform spacings obtained by using sticks of various lengths, depending on the age of the stand. The final thinning is often heavy enough to encourage regeneration. No important diseases or insects are known to affect mangrove forest, though in Nigeria *teredo* is reported to be serious and in the western zone termites are listed as a serious pest to living trees. Attacks by buprestid beetles and lepidopterous borers have also been reported.

Silvicultural Practice

Under these circumstances, it is understandable that a wide variety of natural regeneration methods, including coppice systems, have been employed with mangrove forests. In the Asian area, where experience has been rich and varied, a number of systems ranging from selection, usually to a minimum girth limit, clear-cutting with and without seed trees, and uniform shelterwood have all been tried at some time or other. Such systems have been designed primarily to reproduce the better species, usually *Rhizophora* (or *Bruguiera*) in pure crops. The coppice system has been found satisfactory in some areas, such as in India and the Carribbean, and with some species (Krishnaswamy, 1952; Stehlé, 1945-46), but as previously indicated, not all of the principal mangrove species sprout satisfactorily. Its application is, therefore, limited. For the most part, silvicultural systems have been designed to take advantage of frequent and abundant seeding. Selective cut-

FIGURE 5. – *Extraction by wheelbarrow in mangrove forest, Malaya.* Courtesy, Malayan Forest Service

ting to a fixed minimum girth, while not entirely satisfactory, has produced magnificent crops in many areas. Seed tree cuttings, somewhat more flexible, combined with intermediate fellings to induce advance regeneration, have also been used, though the results have not always been favorable; increased stocking of less desirable species and failures requiring planting have been noted.

Currently, the Malayan system may involve intermediate fellings to induce regeneration in younger age classes, with the final cutting a clear-felling (Noakes, 1954). Results are said to be more satisfactory from the standpoint of volume yield, and adequate regeneration is obtained more uniformly on the cutover area. Planting on the remainder can be done without too much difficulty. There remains, however, the disadvantage that *Bruguiera parviflora* tends to regenerate more readily and is dominant among the seedlings left standing after the final cutting. Rotations have been tried from 20-25 to 40 years but maximum volume of trees, 15 to 30 inches (38 to 76 centimeters) in girth, is obtained with rotations of 30 years, particularly for the mixed *Rhizophora* forest.

In India, various systems have been used. The rotation in Madras is reported by Troup (1921) to be much shorter than in Malaya, in some cases as short as five to ten years. In the Andaman Islands, the most satisfactory method is reported to be clear-cutting and planting. No casualties are replaced, as all blanks are filled with seedlings from seeds, derived from nearby belts of mother trees, carried in by tidal waters. This method of artificial plus natural regeneration is reported as uniformly successful (Banerji, 1954). In the Sundarbans, the largest area under management over many decades, the silvicultural system prescribed is selection and improvement fellings and thinnings (Curtis, 1932).

Further Study Needed

It seems clear that in the mangrove association, special attention must be given to the range of occurrence of a species or association, and the recognition of an optimum belt within the range may help to a large degree to simplify the regeneration problems. Silviculture and management must be concerned with inducing regeneration of a given species or type, whether natural or artificial, for various specific inundation classes. Furthermore, the complicated secondary succession following cutting or natural damage from storms, needs to be investigated, in order to provide a basis for silvicultural practice. Likewise, further study on seed production, the conditions needed for germination and systematic trials, including cost analyses, of different methods of harvest cutting and for the successful establishment of natural regeneration would be desirable.

Nevertheless, although natural regeneration methods are common and, on the whole, successful in mangrove forests, these forests furnish an excellent example of the need to adapt silvicultural practices to local conditions. This must be based on an adequate knowledge

of pertinent silvical characteristics, even in a formation showing broad and conspicuous physiognomic and ecological similarities over a world-wide range.

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CERTIFICATE OF QUALITY

Species: Common name (in the language of the exporting country): . . . . . .

Latin name: . . . . . .

Name and address of the consignor of the sample: . . . . . .

Consignor's description of the sample: . . . . . .

Date of arrival of the sample at the seed control station: . . . . . .

Result of the test *

Degree of purity: . . . . . .

Weight of 1,000 seeds: . . . . . .

Section of whole seeds, percentage of useless seeds: . . . . . .

Germinating capacity: . . . . . .

Any other remarks: . . . . . .

. . . . . .

* Use International Seed Testing Association rules adopted at Dublin, May 1953 . . . . . .

. . . . . .

Certificate:

The above particulars are certified correct.

Director
Seed Testing Station

CERTIFICATE OF ORIGIN

Species: Common name (in the language of the exporting country): . . . . . .
Latin name: . . . . . .

Date of collection: . . . . . .

Location of the seed-producing stand:

Country: . . . . . Area: . . . . . .
District: . . . . . .

Locality: . . . . . Site designation: . . .

Stand number in national register (if possible): . . . . . .

Latitude: . . . . . Longitude: . . . . . .

Altitude: . . . . . (meters above sea level).

Aspect: . . . . . Inclination: . . . . . .

Forest species making up the natural forest (Latin names) — if possible — or reference to phytoclimatic zone: . . . . . .

Geological conditions and types of soil: . . . . . .

Description of the seed-producing stand:

Species: Common name (in the language of the exporting country): . . . . . .
Latin name: . . . . . .

How originating: . . . . . .

Present age: . . . . . .

Present treatment applied: . . . . . .

Seed-bearers:

Diameter: . . . . . Height: . . . . . .

Nature of branches size and inclination: . . . . . .

Shape of boles: . . . . . Age: . . . . . .

Remarks, average date of flushing, etc.: . . . . . .

Certificate:

The above particulars are certified correct by the competent forestry officer: . . . . . .

signature: . . . . . seal . . . . . .

The above particulars have been submitted to: . . . . . .

CONSIGNMENT FORM
FAO

Form for international exchanges of seed and other botanical material intended for scientific purposes

Name and address of consignee: . . . . . .

. . . . . .

Name and address of sender: . . . . . .

. . . . . .

Gross weight of package: . . . . . .

. . . . . .

Nature of contents: . . . . . .

Botanical species: . . . . . .

Common name: . . . . . .

Latin name: . . . . . .

Date, place, and nature of disinfection treatment (if any) to which material has been subjected:

. . . . . .

. . . . . .

The weight of the package must not exceed 1 kilogram (approximately 35 ounces); the stamp or seal (if possible) of the institution and the signature of the official responsible for shipment must appear on it.

NOTE: This form for facilitating the exchange of forest seeds and plant material for scientific use, has been approved by the Sixth Session of the Conference of FAO with the following recommendations:

" 1. that in order to establish authenticity, Member Governments take steps to adopt the Certificates of Quality and Origin . . .;
and,

2. that, to expedite the exchange of seeds and plants for scientific purposes, Member Governments secure recognition by appropriate national agencies of the standard Consignment Form . . . "

International Trade in Forest Tree Seed

N. P. Tulstrup
Secretary, Danish Forestry Society, Copenhagen

International trade in forest tree seed is small in volume and value compared with trade in farm crop seeds but is nevertheless of importance. To those countries where the introduction of exotic species has meant a remarkable increase or improvement in national wood production, the existence and organization of such trade is essential. Potentially an expanded international trade in forest tree seed is a matter of real concern to those countries where tree planting programs are being initiated or enlarged.

Historical review

In the early 1600's, there was already international trade on a modest scale in forest tree seed in Europe. During the following century the trade developed remarkably, and considerable quantities of seed, mainly of Scots pine, Norwegian spruce and European larch of central European origin, were widely distributed. Darmstadt in southern Germany became, in the course of a few decades, the most famous center of forest seed trade, and remained so for more than a century. In the eighteenth century, the first extensive forests of coniferous species were planted outside their natural habitat. At the end of the last century and during the first decades of the present, seed trade in Europe — as far as quantity of seed in the trade is concerned — probably reached its climax.

Records of the total annual volume of the trade in that period are not available, but a few examples from private sources give an idea of its dimensions and character. During the winter 1901/02, a single seed firm at Darmstadt received from France and Belgium more than 200 railway truck-loads of Scots pine cones, the seed of which was widely distributed in Germany and neighboring countries from the Darmstadt-Kiln, simply as seed of " Darmstadt origin ". Almost annually during this period several tons of larch seed of alpine origin were sent to various countries: in 1918-1920, more than 4,000 kilograms went from Switzerland to Britain. Tons of seed of spruce were exported, mainly from the Schwarzwald region in south Germany to Sweden. In 1920-1922, for example, this amounted to 6,000 kilograms. It is also claimed that, in certain years, much spruce seed of southern French origin was exported to Austria and south Germany and there sometimes mixed with seed of local origin for further sale. Increasing quantities of acorns of common and red oak were exported from the Netherlands: during the winter of 1913/14, no less than 120 tons were shipped to a single seed merchant in Copenhagen, Denmark. And many hundreds of kilograms of the fine-grained seed of birch and black alder, the latter now well known for its pronounced climatic races, were collected in Belgium and France and exported via a seed dealer in central Germany, among others, to the same seed firm in Copenhagen, and thence to many widely scattered customers.

Intercontinental trade in forest seed was established in the early days of the eighteenth century, when seed of several eastern American species were frequently shipped to Europe, mainly for use in ornamental plantations. Regular forest plantations of *Picea glauca*, *Pinus strobus*, and a few other American species were, however, also raised shortly after 1700 in Europe. The first seed samples of northwestern American species, including Douglas fir and Sitka spruce, were, as is well known, sent to Europe about 1825 by the famous botanical explorer, David Douglas. Trade on a substantial scale in these species, however, did not begin until after the opening of the Pacific railroad in 1869. The center of the trade in those days was San Francisco, where seed from the northwest was shipped by boat and thence east by train to dealers on the Atlantic coast, or direct to customers in Europe.

Western Canada did not act as an international supplier of forest tree seed until after the first world war. It will be remembered that the Canadian Government after the end of the war shipped, as a gift, seed of Sitka spruce (mainly of Queen Charlotte Islands origin) to war-devastated European countries. Canada, especially British Columbia, is now an important source for seed of various conifers.

The first commercial consignments of Japanese larch from Japan to Europe arrived in the second half of the last century.

The first introductions of eucalypts from Australia took place in the early 1800's, mainly along the Mediterranean coasts and in France. Commercial plantations were, however not raised until the second half of the century, and in some of the main eucalypt-planting countries, such as Brazil, not until 1910 or even

FIGURE 1. – *Roadside plantation of oak, Arnhem, Holland - source of acorns for export.*

later. Now some 600,000 hectares have been planted to eucalypts in Brazil.

Bearing in mind the fact that *Picea glauca* was introduced into Europe about 1,700 from America and mainly used in shelterbelt plantations, it may be mentioned, merely as a curious fact, that seed of this species has been exported in considerable quantities from Europe (Denmark) to Canada during the last decades. Even seed of such American species as Sitka spruce and *Thuja plicata* (both, however, of selected origin) have recently been exported from Denmark to American dealers. This is indeed an improved forest seed version of " carrying coals to Newcastle ".

Volume of trade

In most countries there are no official statistical records as to the volume of the import and export of forest seed. Normally, tree seed will be found in the statistical publications under the heading: " Other seeds (mainly horticultural) ". However, a few examples drawn from available official and private sources may be mentioned to illustrate the volume of the trade. During the past five years, the average annual import of forest tree seed (with the exception of beech and oak) into Western Germany has been about 27 tons, and is increasing. The average annual import value amounted to about 850,000 DM. The import value has, however, varied widely from one year to another, depending on the species of seed introduced. During the same period the average annual export from Germany amounted to about 13 tons, the export value being 160,000 DM.

From Great Britain, one of the main forest seed-importing countries, more specific records are available. The British Forestry Commission itself is importing seed, covering its own as well as the main part of private needs. Home collections in Britain usually meet most of the requirements of broadleaved species such as oak, ash, sycamore and beech; but from time to time it is necessary to seek supplies, especially of beech and oak, from continental Europe. Since 1950, the annual import of beech and oak, mainly of southern German and Austrian origin, has varied between zero and almost 30 tons. The annual import of red oak acorns from the Netherlands was, in the same period, between 10 and 20 tons. For supplies of Scots pine and some of the less widely used conifers, home collections are normally sufficient to provide all requirements. But Sitka and Norwegian spruce, Douglas fir, Japanese larch, and the other important conifers used in Britain's extensive reforestation and afforestation program must be obtained abroad. The total annual import of seed of conifers into Britain has varied since 1950 between 5 and 12 tons, the main items being Japanese larch (between 1 and 2 tons from Japan), Douglas fir (1 ton, mainly from the State of Washington in the United States), Sitka spruce (1 ton, mainly from British Columbia), grand fir (800 kilograms, Washington and British Columbia), Corsican pine (500 kilograms, Corsica), lodgepole pine and Norwegian spruce (various origins).

The Forestry Agency of the Ministry of Agriculture and Forestry in Japan has indicated that the average volume of forest seed exported per year from Japan has for the last three years amounted to almost 8 tons, the main species being Japanese larch (about 6,400 kilograms) and *Cryptomeria japonica* (about 1,200 kilograms).

The Netherlands are now the world's main exporter of common and red oak acorns. For centuries the Dutch people have raised extensive and very beautiful roadside plantations, especially of oak, always selecting in the nurseries for these plantations the plants with the best shape and straightest stems. In spite of the heavy road traffic, most of these often very dense plantations are well maintained, and over-mature trees are replaced with new ones. The trees seed rather abundantly and collection conditions are, as may easily be imagined, generally very good. In certain good seed years hundreds of tons of acorns and beech nuts are exported, mainly to neighboring countries.

However, the annual export of agricultural seed from Denmark alone exceeds 20,000 tons, to the value of U.S.$ 12 million, so that it will be realized from these few examples covering some of the main forest seed importing and exporting countries that the volume and monetary value of the international trade in forest seed is relatively quite small.

Successful establishment of exotics

The importance of international trade in forest tree seed must not, however, be judged solely from statistics. In point of fact, the trade has been, and still is, of con-

siderably greater importance than might be gleaned from the bare import and export figures. In Britain, for example, the Forestry Commission's planting program envisages domestic forests producing, before the end of this century, more than one third of all the timber needed in Britain, the leading European timber-importing country, as compared with only 4 percent in 1938. Such an enormous increase in the national timber production would certainly be impossible without the successful establishment of exotic conifers, originally from introduced seed.

Denmark presents another European example of the successful introduction of numerous exotics. In this country with no native coniferous species of commercial importance, and a forest area comprising only about 9 percent of the total land area, exotic conifers (mainly Norwegian spruce) were introduced on a large scale already in the eighteenth century, and are now planted on 75 percent of the forest area. These intensively-managed plantations (covering 211,000 hectares) are at present supplying more than 50 percent of the Danish softwood requirements, and even allowing an export of certain softwood products. Furthermore, the Danish beech and oak woods have to some extent been improved in quality through frequent introductions of seed of better races than the indigenous forests of these species.

However, the most striking example of successful establishment of an exotic is that of radiata or insignis pine (*Pinus radiata*) into Southern Hemisphere countries from its very limited area of natural occurrence on the Monterey peninsula of California. It was introduced into New Zealand by the settlers about 1860 and planted mainly for shelter. But as its potentialities for growth became obvious, it was used extensively for planting, with the result that about 228,000 hectares of *P. radiata* plantations have been established, or over 60 percent of the area for all species planted in New Zealand, and in the near future it is likely to be the country's most important timber. In the Union of South Africa, in Australia and in the south-central part of Chile this species has also been successfully introduced. In Chile, it extends over well above 200,000 hectares, the annual increment is about 2.8 million cubic meters, and the tree constitutes one of the most important potential raw material resources for the production of pulp and paper in Latin America. Similarly, *Pinus canariensis*, one of the best pine timbers, has a limited natural occurrence in the Canary Islands, 750 to 2,400 meters above sea level, but has been successfully introduced under a wide range of conditions. Since 1898, it has been planted on a large scale in the Union of South Africa, as have *Pinus patula* and various other pines of Mexican origin.

Eucalyptus undoubtedly constitutes the best-known exotic in many countries. All the eucalypts important from the forestry standpoint occur naturally only in Australia, but eucalypt plantations covering more than 1 million hectares have been created in various countries lying in world climatic zones of subtropical or Mediterranean type. On rotations of frequently only 9 to 10 years, they form the basis of very considerable industrial concerns. Most eucalypt species seed early and frequently, and the minute seed is easy to store over longer periods. The Director General of the Forestry and Timber Bureau at Canberra, Australia, has kindly informed the author that, for the last six years, the average annual export of eucalypt seed from Australian Government Departments has been about 62 kilograms and from private suppliers, 15 kilograms, but it is thought that the available figures in the case of private suppliers fall far short of the actual totals. The Forestry and Timber Bureau at Canberra is now acting as a central clearing house for orders for Australian forest tree seed.

Although spectacular results have been obtained with the introduction of eucalypts and radiata pine in several countries, the various northwestern American, European and Japanese species still represent at present a much more important element in international trade in forest tree seed for a large number of countries.

Importance of provenance and seed certification

The above are a few examples of successful introductions. There are other examples of unsuccessful importations which emphasize the need for a well-organized forest tree seed trade and exchange.

FIGURE 2. – *Douglas fir forest from northwestern United States seed, in Denmark.*

FIGURE 3. – *Japanese larch forest, 50 years old, in Denmark, from Japanese seed.*

It was recognized already in the early 1800's that Scots pine, the leading European timber in those days, showed considerable variation according to the different seed origins from which the trees derived. Some yielded timber of good, and some of bad, quality for ship building and similar constructional purposes. Some grew vigorously or comparatively well where others failed at an early age. In 1821, the first provenance trials in Scots pine were laid out, and it soon became evident that there were important racial differences. But not until the early years of the present century, in certain cases not until the last few decades, has any noteworthy attention been paid to the important question of origin of the seed. It was considered foolish not to buy where seed was cheapest.

Accordingly, considerable quantities of Scots pine seed of southern origin were, as indicated earlier, widely distributed simply because such seed was cheaper and frequently of better germinative capacity than seed of local origin in the importing countries. In numerous cases, severe losses were suffered by the forest owners when seed of unsuitable origin had been used. Black alder, with its pronounced climatic races, Norwegian spruce as exported in certain years from Finland and northern Scandinavia to southern countries, European larch of alpine origin, Douglas fir of Shuswap strain as exported to Britain, Denmark and other European countries with similar climatic conditions, and beech nuts collected under badly-shaped but abundantly seeding trees in Holland and various other countries, constitute further examples of indiscriminate and unfortunate seed imports. Even after the second world war, commercial consignments of European larch of alpine origin have been introduced into countries where it had already long ago been demonstrated that the young larch trees of that origin would be violently attacked by canker (*Dasyscypha willkommii*).

Especially since the 1920's, a mass of evidence has accumulated showing the existence of climatic, form, and perhaps also soil, races within many forest tree species, and it is now generally recognized that seed source in forestry is second in importance only to choice of species for planting projects. In forestry, it is even more important than in agriculture to use seed of the most suitable origin because of the long rotation normally involved from planting to cutting of the mature trees, and the resultant long time it takes to recognize a possible failure in the choice of seed source.

Despite this realization, international trade in forest tree seed still lacks a foundation of certainty as regards origin of seed, although the trade is improving as buyers are becoming more discriminating. Several countries, including the United Kingdom, France, Belgium, Switzerland and Western Germany, have passed laws providing restrictions to stop the import of seed of unsuitable origin. The effectiveness of such laws depends not only on the co-operation of suppliers and users, but also on the supervision and inspection of imports. This latter point is rather difficult in many instances because labeling is often inadequate, due to lack of detailed knowledge on the part of the shipper or supplier, as to origin of the seed. Furthermore, in quite a number of commercially important species, our knowledge as to the development of races is still very incomplete.

Merely as a curious example, it may be mentioned that a few years ago several consignments of Douglas fir seed were imported freely simply as " conifer seed " into a country where Douglas fir seed must not be imported without passing a plant disease control. Under the heading (*c*) in the local import rules, the frontier control officer could not find any " black list " species (whereas under the heading (*d*) Douglas fir was, of course, recorded as " import forbidden "). Consequently, he had allowed the seed to pass without any disease control.

From the above, it should be clear that the widespread use of the forest seed certificate form adopted by the 1951 FAO Conference offers obvious advantages to both suppliers and purchasers of forest tree seed. These certificate forms were the subject of discussion at the 1959 session of the European Forestry Commission, and the Commission felt that now, after 8 years of use, the revision of these forms, which are reproduced here, should be considered. Readers are invited to offer suggestions for such revision.

As a help to seed users and tree planters, FAO has attempted to supply practical information on growth and seeding habits of principal species useful for plant-

ing programs through a series of Development Papers published in the World Planting Manual series. These now include: *Forest Plantation Protection against Diseases and Insect Pests* (No. 3); *Handling Forest Tree Seed* (No. 4); *Tree Seed Notes* (No. 5); *Tree Planting Practices for Arid Areas* (No. 6); *Tropical Africa* (No. 8); *Temperate Asia* (Nos. 10 and 14); *Tropical Asia* (No. 11); *Choice of Species* (No. 13); and, soon to be published, *Tree Planting Practices for Latin America*. In addition, Forestry Studies *Eucalypts for Planting* (No. 11) and *Poplars in Forestry and Land Use* (No. 12) provide useful information on these two important genera, and a monograph on radiata pine is in preparation. Many individual countries have prepared valuable publications along similar lines for their own national conditions. More of these are needed, and this would be a desirable activity of various national "World Seed Year" campaigns.

FAO also issued in 1956 a *Forest Tree Seed Directory*, listing reliable suppliers of over 1,000 species and reproducing the FAO certificates of seed quality and origin, and consignment form. A special World Seed Year edition of the *Forest Tree Seed Directory* will be available for 1961. The private seed dealers listed in the 1956 edition of the Directory comprise those submitted by Member Governments as being of sufficient size to warrant inclusion. The number is comparatively small, and for the most part these dealers are concentrated in the United States, central and northern Europe.

In most countries the forest seed trade is frequently a state-forest enterprise. However, there are the same advantages in a greater development of private forest tree seed trade as there are in private trade in agricultural seed or in other business enterprises. There are, in fact, some outstanding examples, as in the northwestern region of the United States, of progressive private dealers who have gone a long way toward delimiting specific geographic zones for collection and certification of origin of such important species as Douglas fir, and have succeeded in building a thriving business based on reliable, authenticated, well-tested seed. There would seem to be little doubt that the healthy and successful competition between private and state-enterprise organizations, in countries where these exist, in forest tree seed, must depend on the adoption and careful adherence to a universally acceptable seed certification system.

Future trend in international trade

What is the future outlook for international trade in forest tree seed? The lack of statistical records of past trade makes it difficult to answer this question specifically.

The increasing use of artificial regeneration of forests as compared with natural regeneration, and the extensive afforestation projects planned or under development in various parts of the world should involve an increasing demand for forest seed. In a few countries, extensive stands of the more important exotics already have attained seeding age; improved storing methods for the seed of many species are being developed; and seed orchards are being established to produce seed of superior or elite trees. This may mean that the requirements for seed in these countries will be met partly or wholly from home collections, even in the lean seed years. It has been generally observed (incidentally) that seed harvested from local stands of exotics often produces plants more fit for growing under the local conditions than does seed of the same species from abroad. Nevertheless, the seed from exotic plantations, seed orchards, and seed production stands may also become available for export to other countries in due course. As the results of past introductions of exotic species show the desirability of better choice of species and especially of better geographic or climatic races and genetic strains, the demand for such superior seed is bound to increase.

Considering all these elements, it can be concluded that the demand for authenticated seed from well-defined zones, and from carefully selected genetically superior trees, backed up by proper certificates of origin and quality, will continue upward. This should lend greater importance to a well-organized international trade in forest tree seed, based on close co-operation between private suppliers and government authorities.

Commodity Report

Pulp and Paper Demand, Supply and Trade

A World Consultation on Pulp and Paper Demand, Supply and Trade took place at FAO Headquarters at Rome from 14-19 September 1959. Twenty-seven experts and advisers from the following countries participated: Argentina, Australia, Brazil, Canada, Federal Republic of Germany, Finland, France, India, Italy, Japan, Norway, Sweden, Union of South Africa, United Kingdom, United States, Uruguay.

Also taking part in the Consultation were representatives of the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the Organization for European Economic Co-operation (OEEC). A list of participants is attached to this report as Annex I.

2. Mr. Glesinger, Director of the Forestry and Forest Products Division of FAO, welcoming the participants on behalf of the Director-General of FAO, outlined the principal developments in the world pulp and paper situation which had occurred in the decade since the FAO Preparatory Conference on World Pulp Problems was held in Montreal in 1949, and gave a short account of the aims and progress of FAO's own program in the field of pulp and paper.

3. Mr. Robert Fowler, President of the Canadian Pulp and Paper Association, was unanimously elected Chairman of the Consultation.

Demand for Paper and Board

4. After the Secretary, Arne Sundelin of FAO, had briefly outlined the documentation prepared for the meeting, the Consultation discussed, on the basis of document FAO/WPPC-59/15: "Comparison of Earlier Demand Forecasts", the various attempts at forecasting pulp and paper requirements which had been made by international and national agencies during the past decade [1]. The review of these demand forecasts led to the following conclusions:

(*a*) practically all the earliest attempts at demand projection had underestimated — in most cases seriously — the actual course of consumption. This was particularly true of those projections which were in the nature of informed guesses rather than based upon explicit statistical procedures.

[1] In the following pages, all tons are metric tons. Unless otherwise stated, pulp refers to pulp for paper-making only (whether of wood or of other fibre) and excludes dissolving pulp.

Fibreboard (building boards) are excluded from all paperboard figures.

The projections of demand (and hence the estimates of regional balances, etc.) have been arrived at by statistical methods, but the number of significant figures given is no indication of precision.

Table 1. – Estimates of Paper and Paperboard Demand: 1965 and 1975

Region	Economic growth rate per capita		Newsprint			Other paper and paperboard			Total paper and paperboard		
	1955–65	1965–75	1955	1965	1975	1955	1965	1975	1955	1965	1975
	percent per year		*in thousand metric tons*								
North America	2.25	2.00	6 351	8 300	10 300	25 171	35 400	47 000	31 522	43 700	57 300
Latin America	2.50	2.00	495	1 000	1 800	1 327	2 500	4 700	1 822	3 500	6 500
Western Europe	2.50	2.00	2 648	4 200	6 000	10 505	15 500	21 200	13 153	19 700	27 200
Eastern Europe	.. see text ..		222	450	900	1 668	3 200	5 700	1 890	3 700	6 600
U.S.S.R.	.. see text ..		307	850	1 800	2 168	5 300	10 600	2 475	6 100	12 400
Africa	2.00	2.00	102	190	350	384	700	1 300	486	900	1 600
Near and Middle East	2.00	2.00	31	65	120	108	210	400	139	280	520
Far East (excl. Japan and Mainland China)	2.00	2.00	221	430	850	609	1 160	2 300	830	1 600	3 100
Japan	4.50	4.00	454	950	1 600	1 695	3 600	6 400	2 149	4 500	8 000
Mainland China	.. see text ..		141	500	1 600	727	2 400	7 200	868	2 900	8 800
Oceania	2.50	2.00	310	450	600	450	800	1 200	760	1 300	1 800
World total	—	—	11 280	17 400	26 000	44 810	70 700	108 000	56 090	88 000	134 000

Note: Totals may not add up because of rounding of figures in the world total.

While in general the more sophisticated approaches had yielded superior results, not all these had been successful in closely predicting the actual course of consumption. In these instances, however, it was usually possible to see clearly the reason for the discrepancy between projected demand and actual consumption, e.g., the economic growth rate or the population trend had been different from that assumed, or incorrect relationships between consumption growth and income growth (income elasticities) had been used.

Two facts had to be borne in mind in assessing the validity of past estimates: (i) until quite recently the statistics available for studies of this kind have been far from satisfactory; (ii) the pattern of economic growth during the last decade has been disturbed by the Korean crisis and the cold war.

(*b*) Two developments had made possible an improvement in the techniques of demand projection during the decade. Firstly, there had been a considerable improvement in the scope and geographical coverage of the statistical information necessary for the prosecution of demand studies, e.g., pulp and paper production and consumption figures, national income data, population data, etc. Secondly, considerable experience has been acquired in carrying out demand studies for other commodities and some of this experience has been applied to the pulp and paper field.

(*c*) The most promising approach, particularly in studies of regional consumption and in cases where paper consumption statistics are available only for broad categories of paper, lay in establishing a relationship between the growth in paper consumption and the growth in the general economy.

5. After reviewing earlier attempts at forecasting demand for pulp and paper, the Consultation discussed Secretariat Paper FAO/WPPC-59/2: "A Forecast of Demand for the Period to 1975". It was agreed that demand projections, based on statistical analysis and adjusted where necessary to take into account local circumstances which might call for special treatment, presented valuable indications to all those in government and industry concerned with development planning. They made possible the formulation of policies designed to ensure market stability and to avert serious imbalances between supply and consumption. While recognizing the limitations of demand forecasting, as stated in the Secretariat paper, the Consultation attached great importance to such investigations, not as predictions, but as working tools.

6. The Consultation noted that the demand projections presented by the Secretariat claimed only to give an indication of growth in consumption that could be expected to attend a given income growth. The realization of these forecasts is conditioned by the economic growth rates which will actually occur; the forecasting of these is a matter of judgment. The estimates should be viewed as relating to future income levels rather than particular years.

7. The Consultation considered that the analysis presented by the Secretariat clearly established the existence of the two following phenomena:

(*a*) The change in consumption corresponding to a given change in national income differs according to the level of national income. The response is relatively higher at low income levels than at high income levels (i.e., demand elasticity declines as income rises).

(*b*) At any given income level, the relationship between income and consumption established on the basis of country by country comparisons (i.e., cross-sectional analysis) differs slightly from the relationship established on the basis of historical data (time series). In general, country by country comparisons seem to indicate a slightly lower response of consumption to income change than do the historical data for particular countries or regions (i.e., demand elasticities at a given income derived from cross-sectional analysis slightly exceed those derived from time series).

8. Regarding (*a*), the Consultation believed that the analysis presented by the Secretariat, embodying techniques developed in the study of demand for other commodities but not previously applied to pulp and paper, succeeded in accounting satisfactorily for this observed phenomenon and represented a considerable advance on the methodology used in previous pulp and paper demand studies. Participants expressed the hope that the Secretariat would continue its studies and report its findings from time to time.

9. Regarding (*b*), the Consultation expressed particular interest in the Secretariat's analysis of the growth in demand that may be ascribed to miscellaneous factors other than income and population growth (referred to in the Secretariat paper as the "time trend"). The Consultation believed that this offered a particularly fruitful field for further investigations.

Among the factors which may influence this residual trend positively (or negatively) may be instanced: technological developments affecting the use of paper (or its alternatives); changes in national habits; changes in the relative price of paper; and governmental policies. For example, an exceptionally rapid rise in the demand for printing, and writing paper may occur in low income countries where intensive efforts are being made to reduce illiteracy. On the other hand, trade barriers in the form of duties, quantitative or currency restrictions which impede the free exchange of goods between countries can, through their effects on the price structure, tend to inhibit the growth in consumption. The existence and uncertain impact of these other factors pointed to the desirability of further investigations into the elements constituting the "time trend".

10. Endorsing the methodological approach adopted by the Secretariat, the Consultation emphasized the following reservations included in the Secretariat paper:

(*a*) The method was suitable for medium- and long-term projections only. Short-term projections, which lay outside the scope of the Secretariat paper, called for different techniques.

(*b*) Other, and more elaborate, procedures could be applied to projections for individual countries where ample data were available on consumption of paper by detailed categories and on the various economic factors influencing the demand for each category.

They added that:

(*c*) The fact that the projections might be influenced by the limited base period selected constituted a further argument for continuous review.

11. The Consultation recommended that the Secretariat of FAO:

(*a*) continue to study the methodology of forecasting pulp and paper demand, especially as regards methods appropriate to projections for individual countries;

(*b*) periodically review its regional and world demand forecasts in the light of the latest trends in economic and population growth and in paper consumption;

(*c*) extend its investigations of factors other than income and population growth which may influence demand trends.

12. In reviewing, region by region, estimates of future paper and board demand presented in the Secretariat paper and summarized in Table 1, the Consultation offered the following comments:

North America

Demand projections recently carried out in Canada though prepared on the basis quite different from that used by the Secretariat (including a somewhat lower economic growth rate to 1965), had yielded figures extremely close to those included in the Secretariat Paper. Similarly, a recent United States projection (by the American Pulp and Paper Association), when adjusted to eliminate building paper and board (not included in the Secretariat estimates), also came close to the Secretariat's estimates, though the United States projection had been based on a somewhat lower rate of economic growth and a slightly higher population trend. In general, the North American projection envisaged a somewhat greater rise in paperboard requirements than in the Secretariat paper. It was the view of the North American participants that the Secretariat's estimates represented a reasonable assessment of the demand trend in the North American region.

Latin America

Participants from Latin America endorsed the estimates for the region submitted by the Secretariat with the minor reservation that the growth rates selected might prove to be slightly low. It was noted that a further rapid increase in paper requirements was expected in Argentina, where paper consumption has been artificially restricted during much of the postwar period.

Western Europe

The Consultation noted that estimating the future trend of demand in Western Europe presented special problems. In interpreting the past trend it had to be borne in mind that much of the region's capacity had been destroyed during the war, and that restrictions on consumption had continued in a number of countries until quite recently. At the same time, economic growth had been extremely rapid. Factors other than income growth had thus influenced the recent rise in consumption; the problem was to quantify these other factors and assess their future impact. The Secretariat estimate included in Table 1 incorporated a small arbitrary adjustment to take account of these factors.

The Secretariat had prepared an alternative estimate on the assumption that these factors would continue to influence the course of demand though less strongly than in the course of the past decade. This led to the following figures for 1965:

	Million tons
Newsprint	4.60
Other papers and board	16.75
Total, paper and board	21.35

The OEEC representative gave an account of a projection to 1965 recently carried out by the Pulp and Paper Committee of the OEEC, based on historical trends and assuming a 3 percent annual rise in gross output, which yielded figures close to those of the alternative Secretariat estimate.

Comments by other West European participants demonstrated general agreement that the two Secretariat estimates might be regarded as reasonable lower and upper limits of the likely trend in demand in Western Europe.

Oceania

The Australian participant agreed that the estimates for Oceania represented the right order of magnitude, but suggested that for the year 1975 the newsprint estimate might prove slightly low and that for paperboard somewhat high.

The Far East

The Consultation recognized the validity of arguments submitted by the Asian participants criticizing the figures in the Secretariat paper as being serious underestimates, but hesitated to pronounce themselves on how far these figures should be augmented.

Japan

The Japanese participants pointed out that the economic growth rates assumed (4.5 and 4 percent *per caput* for the current and succeeding decades respectively) were substantially lower than those provided for in the current development plan.

Current plans for paper production in Japan envisaged an output of 5.4 million metric tons for 1965 and 10.5 million metric tons by 1975 compared with the current (1958) production of 3.14 million metric tons.

These plans correspond to per capita income growth rates of approximately 5.65 percent to 1965 and 5.3 thereafter until 1975. Doubt was expressed by the Consultation as to the possibility of maintaining these high growth rates through two decades.

Far East, excluding Japan and Mainland China

The Indian participants pointed out that government and industry plans in India provided for a much more rapid rise in paper production and consumption than would correspond to income growth and, hence, than provided for in the Secretariat estimates. This was a deliberate policy to provide the paper necessary to fulfil the literacy campaign on which India was engaged. Similar factors certainly influence, though perhaps to a lesser degree, the trend of demand in the rest of this sub-region. India's plans envisaged a domestic paper production by 1965 of 150 thousand tons of newsprint and 700 thousand tons of paper and board. In the ensuing decade, to 1975, an annual rise in production of the order of 10 percent was foreseen.

The Consultation agreed that the estimates for the Far East (excluding Japan and Mainland China) required some upward revision. It noted that the Conference on Pulp and Paper Development in Asia and the Far East, sponsored by FAO and by the Economic Commission for Asia and the Far East (ECAFE) and which was being held in Tokyo in 1960 at the invitation of the Japanese Government, would provide an opportunity for improving these estimates and getting a clearer picture of prospects in the region.

Africa, Near and Middle East

No comments were offered by participants on the estimates for these two regions. The Secretariat pointed out that the estimates for the Near and Middle East were in conformity with the projections included in the Mediterranean Development report, recently prepared by FAO.

U.S.S.R., Eastern Europe and Mainland China

The Secretariat explained that the relationship between income growth and the rising paper consumption was very different in countries with planned economies from that which pertained in free enterprise economies. Planned production figures (which closely approximate to consumption) covering the next few years were available for these regions; these plans fell far short of the expansion that might be expected to attend the planned paper production figures and had inferred therefrom a theoretical economic growth rate — in each case considerably below either past or projected income growth rates. This theoretical economic growth rate, adjusted downwards for the decade 1965 to 1975 in the case of the U.S.S.R., had then been used to project paper requirements for 1965 to 1975. The Consultation endorsed this procedure as being the most rational way to arrive at an assessment of likely trends in demand for these regions. It noted that there might conceivably be a " natural " level of consumption appropriate to a given income in countries with fully planned economies, somewhat lower than the " natural " level in free enterprise economies at corresponding income levels. It noted that the very high future paper requirements in Mainland China indicated by the Secretariat estimates represented extremely ambitious targets, the realization of which would depend upon the ability of the Chinese to produce or import the necessary equipment and develop the required raw material resources.

The Consultation requested the Secretariat to take account of the foregoing observations in revising the Secretariat papers for publication. It observed that the review it had conducted of the Secretariat estimates, region by region, led to the conclusion that the global estimates of the likely trends in world demand for paper and board by the years 1965 and 1975 could be broadly accepted. A world requirement of 88 million tons around the year 1965 and of 134 million tons a decade or so later, it was noted, represented an expansion rate somewhat lower than that which had prevailed in the recent past.

Pulp Requirements

13. Having reviewed the estimates of future paper and board demand submitted by the Secretariat, the Consultation considered the pulp requirements implied by these estimates. The Secretariat invited comment on the conversion factors and waste paper recovery rates which had been assumed.

North American and Scandinavian participants indicated that a fibre requirement of 1.06 air dry tons on average per ton of paper and paperboard was slightly higher than current practice in their areas. Having regard to practice in Western European pulp deficit countries and likely future trends, this figure was considered acceptable for projecting pulp requirements in North America and Western Europe. For other regions of the world the figure of 1.08 tons was accepted as a reasonable average for the regions as a whole.

14. The Consultation discussed some of the factors likely to influence waste paper recovery rates in the future. It was pointed out that, in several countries, a greater relative use of virgin fibre was required to meet consumer preferences. The development of new types of paper incorporating plastic and other materials

had added to the difficulty and cost of sorting and cleaning for repulping. On the other hand, in most regions a relatively more rapid expansion was foreseen in the output of those paper categories in the production of which waste paper can be used in substantial amounts. The quantities of waste paper used depended on the cost of virgin fibre relative to that of waste paper; a sustained change in this relative cost might lead to higher or lower recovery rates.

On balance the Consultation believed that, for North America, Western Europe and Oceania, it would be reasonable to assume a continuation of current recovery rates. In other regions, where rising paper consumption *per caput* will greatly facilitate salvage, a rise in the recovery rates must, as indicated in the Secretariat paper, be assumed. The Consultation therefore, requested the Secretariat to re-calculate future pulp requirements on the basis of the following assumed waste paper recovery rates (Table 2).

Table 2. – Estimated Waste Paper Recovery Rates: Percent of Paper Consumption

Region	1955	1965	1975
North America	26	26	26
Latin America	20	21	23
Western Europe	25	25	25
Eastern Europe	22	23	24
U.S.S.R.	14	16	18
Africa	9	10	12
Near and Middle East	8	9	10
Far East, excluding Japan and Mainland China	17	18	18
Japan	25	28	29
Mainland China	12	14	16
Oceania	12	12	12

Capacity

15. The Consultation turned to a discussion of Secretariat Paper FAO/WPPC-59/3: "Meeting Future Needs", taking up first the definition of capacity. It became evident in the course of the discussion that the capacity data submitted to the Secretariat and incorporated in the Secretariat Paper had been compiled on bases that differed from country to country. Some of the difficulties of arriving at an agreed concept of capacity for pulp and paper mills were touched upon, e. g., the number of days worked per year, the production programs (in the case of plants capable of producing a variety of papers), the quality of the pulp or paper produced, efficiency of operations, etc. The United States participants reported that agreement had been reached in the United States pulp industry on a definition of capacity, that figures had been collected and analyzed for many years past and had proved extremely useful. Similarly, capacity figures had been collected from paper mills, though the industry had recently decided to bring its definition of capacity into closer agreement with that used in the pulp industry, figures hitherto collected having been shown to understate production possibilities. In Canada also, detailed capacity figures on a satisfactory basis have been collected for many years.

The Consultation considered it highly desirable that a clear, and if possible internationally comparable, definition be established in all countries. The United States and Canadian definitions were made available to the Consultation and the Secretariat undertook to circulate these to all participants.

The Consultation learned with satisfaction that the Pulp and Paper Committee of OEEC is convening a Working Party specifically to consider this problem for Western European countries. The problem, however, was not limited to North America and Western Europe and the Consultation requested FAO, once it has been advised of the outcome of the discussions of the OEEC Working Party, to take whatever steps are possible to foster international agreement on definitions.

16. The Consultation next considered the validity of the presentation in the Secretariat paper of two concepts of capacity: *rated capacity*, representing maximum production possibilities under existing conditions; and *normal capacity*, which not only takes into account the fact that all-out capacity is unlikely to be realized in practice but which also makes allowance for a marginal reserve capable of absorbing temporary unexpected increases in demand as well as unforeseen set-backs in the production schedule. The Consultation agreed that, in the pulp and paper industries, as in other basic industries, failure to allow for a marginal reserve was as dangerous for market stability as an excessive reserve capacity. It was observed that, since the war when demand was buoyant, the industry in several countries had operated at close to rated capacity (as defined above) for prolonged periods; this was in marked contrast with prewar experience, and had undoubtedly encouraged investors, led to the multiplication of capacity expansion plans, and contributed to current excess capacity in North America and Western Europe. The Consultation recommended that, in the light of the discussion which had taken place on rated and normal capacity, a notional marginal reserve of 5 percent for both the pulp and paper industries (i. e., a normal operating ratio of 95 percent) should be adopted for the Secretariat presentation with the understanding that this was a provisional figure. It was recognized that for many countries a marginal reserve of 5 percent was an inadequate allowance and that it might prove necessary in future studies to assume lower operating rates in certain regions.

17. Taking into account new information which had reached the Secretariat since the preparation of the Secretariat paper, and following individual consultations between the Secretariat and participants, the Consultation agreed on the estimates of existing rated capacity and capacity expansion plans incorporated in Table 3.

TABLE 3. – ESTIMATED EXISTING CAPACITY AND CURRENT EXPANSION PLANS, BY REGIONS

Region	Rated capacity 1958			Current expansion plans				Estimate of future rated capacity				
	Newsprint	Other paper and paperboard	Total paper and paperboard	Paper pulp	Newsprint	Other paper and paperboard	Total paper and paperboard	Paper pulp	Newsprint	Other paper and paperboard	Total paper and paperboard	Paper pulp	Estimated target date
	1,000 metric tons												
North America	8 521	32 533	41 054	33 730	678	3 238	3 916	1 240	9 200	35 770	44 970	34 970	1961/62
Latin America	150	1 500	1 650	830	405	915	1 320	1 410	560	2 420	2 980	2 240	1964/65
Western Europe	3 910	14 750	18 660	14 750	740	2 965	3 705	4 950	4 520	17 720	22 240	19 690	1963/65
Africa	—	270	270	175	70	90	160	345	70	360	430	520	1964/65
Near and Middle East	15	65	80	50	40	285	325	110	60	360	420	160	—
Far East	700	3 685	4 385	2 700	480	1 140	1 620	960	1 180	4 830	6 010	3 660	—
Oceania	170	400	570	480	70	190	260	150	240	590	830	630	1964/65
Rest of the World	980	6 150	7 130	6 565	945	5 215	6 160	5 435	1 930	11 370	13 300	12 090	1965
TOTAL	14 446	59 353	73 799	59 280	3 428	14 038	17 466	14 600	17 760	73 420	91 180	73 960	

Participants expressed their satisfaction at the opportunity this Consultation had afforded for a free and frank discussion of problems relating to capacity and which had led to the establishment of the estimates included in this Table. The Consultation expressed the hope that FAO would provide similar opportunities in the future for a periodical exchange of information on capacity and participants indicated their willingness to do what they could to have the necessary data made available.

18. The Consultation noted that a comparison of rated capacity and production figures in 1958 showed operating ratios of 84 percent in North America and 83 percent in Western Europe for the newsprint industry, and of 82 percent in North America and 89 percent in Western Europe for other sectors of the paper industry. In the rest of the world the operating ratio averaged 90 percent for newsprint and 85 percent for other sectors.

Allowing 5 percent as a marginal reserve capacity, these figures indicated that in relation to current demand there existed in the year 1958 in the several regions excess capacity as follows in Table 4.

TABLE 4. – ESTIMATES OF EXCESS CAPACITIES[1] IN THE PULP AND PAPER INDUSTRIES IN 1958

	North America	Western Europe	Rest of the world[2]	Total
	in million metric tons			
Newsprint	0.97	0.47	0.09	1.53
Other paper and board	4.36	0.98	0.72	6.06
Total paper and board	5.33	1.45	0.81	7.59
Pulp[3]	4.90	1.5	0.40	6.8

[1] Normal capacity (i.e., 95 percent operating ratio) less actual production.

[2] Figures for the rest of the world are largely conjectural; they have been calculated on a basis of a 5 percent marginal reserve, admittedly an inadequate margin in many areas outside Europe and North America.

[3] See qualification in the text.

The existence of an estimated 7½ million tons excess capacity in the world paper and board industry in 1958 would suggest that industry in the preceding few years had seriously overestimated the recent trend in consumption. It should be borne in mind, however, that the 1957/58 check in economic growth and hence in paper consumption could not have been foreseen at the time when plans for recent expansions were initiated. Had paper consumption since 1956 followed the trend of preceding years, over 3 million tons more paper might have been consumed in 1958. From this standpoint, the degree of overexpansion can be fairly regarded not as 7½ million tons, but as 4½ million tons—still a substantial figure.

As regards the excess capacity indicated for pulp, the Consultation drew attention to the fact that a substantial proportion of the excess shown represented capacity in integrated mills which is not normally diverted to the market.

TABLE 5. – BALANCE BETWEEN PROJECTED NORMAL CAPACITY AND PROJECTED 1965 DEMAND

Region	Newsprint	Other paper and board	Total paper and board	Paper pulp
	in million metric tons			
North America	+0.43	—1.40	—0.97	—0.70
Western Europe	—0.31	+0.08	—0.23	+1.66
Subtotal	*+0.12*	*—1.32*	*—1.20*	*+0.96*
Latin America	—0.44	—0.21	—0.65	—0.20
Africa	—0.12	—0.36	—0.48	+0.14
Near and Middle East	—	+0.13	+0.13	—0.26
Far East	—0.25	—0.13	—0.38	—0.80
Oceania	—0.23	—0.25	—0.48	—0.10
Subtotal	*—1.04*	*—0.82*	*—1.86*	*—1.22*
Rest of the World	*+0.02*	*—0.10*	*—0.08*	*+0.08*
TOTAL	*—0.90*	*—2.24*	*—3.14*	*—0.18*

NOTE: Indicated surplus (+) or deficit (—).

Table 6. – Comparison of Current and Estimated 1965 Balances for Paper and Pulp in Certain Regions

Region	Newsprint		Other paper and board		Total paper and board		Paper pulp	
	1957/58	1965	1957/58	1965	1957/58	1965	1957/58	1965
	in million metric tons							
Latin America	— 0.51	— 0.44	— 0.38	— 0.21	— 0.89	— 0.65	— 0.29	— 0.20
Africa	— 0.12	— 0.12	— 0.21	— 0.36	— 0.33	— 0.48	— 0.02	+ 0.14
Near and Middle East	— 0.02	—	— 0.09	+ 0.13	— 0.11	+ 0.13	— 0.02	+ 0.26
Far East	— 0.18	— 0.25	— 0.23	— 0.13	— 0.41	— 0.38	— 0.08	— 0.80
Oceania	— 0.18	— 0.23	— 0.11	— 0.25	— 0.29	— 0.48	— 0.04	— 0.10
Total	— 1.01	— 1.04	— 1.02	— .82	— 2.03	— 1.86	— 0.45	— 1.22

Note: Surplus (+) or deficit (—).
The average 1957/58 surplus and deficit tonnages refer to actual net exports and imports respectively.

19. The Consultation next considered the situation that might arise in 1965 if demand in each region followed the trend indicated by the Secretariat estimates, taking into account existing capacity and capacity expansion plans as set out above, but making no allowance for any further expansions that might take place. A comparison of estimated 1965 demand and normal capacity led to the notional balances for newsprint, other paper and board and paper pulp in the several regions indicated Table 5.

In arriving at the balance for Western Europe, the alternative Secretariat estimate of demand in 1965 was selected (see para. 12). The Consultation noted that for the current pulp and paper deficit areas, whose expansion plans in general covered the period up to 1965, the aggregate deficit in newsprint as compared with 1957/58 seemed likely to show little change, that for other paper and board would decline by about 200,000 tons, while the pulp deficit would rise from 450,000 tons to 1.22 million tons as shown in Table 6.

The Consultation considered that these estimated regional balances might lead to aggregate net import requirements in 1965 by these regions as follows:

Newsprint	Other paper and board	Total paper and board	Paper pulp
1.04	0.79	1.83	1.13

If it is assumed that these requirements are met by net exports from North America and Western Europe approximately in the proportions that have recently prevailed, this would signify net exports from these two regions in 1965 as follows in Table 7.

Table 7. – Estimated Net Exports from North America and Western Europe in 1965

Region	Newsprint	Other paper and board	Total paper and board	Paper pulp
	in million metric tons			
North America	0.92	0.26	1.18	0.52
Western Europe	0.06	0.70	0.76	0.61

To satisfy internal demand and to provide for these net exports these two regions would by 1965 require a rated capacity (assuming an operating ratio of 95 percent) as indicated in the following Table. This table also reproduces figures of currently planned rated capacity and thus gives, by deduction, an estimate of apparent additional capacity requirememts.

Table 8. – Apparent Rated Capacity Requirements in North America and Western Europe as compared with Current Plans

Region and Commodity	Existing and currently planned	Required	Apparent additional requirements
	in million metric tons		
North America			
Newsprint	9.20	9.72	0.52
Other papers and board	35.77	37.52	*1.75*
Subtotal	*44.97*	*47.24*	*2.27*
Paper pulp	34.97	38.65	3.68
Western Europe			
Newsprint	4.52	4.91	0.39
Other papers and board	17.72	18.37	0.65
Subtotal	*22.24*	*23.28*	*1.40*
Paper pulp	19.69	19.69	—

If no further additional paper and board capacity were added by 1965 in North America both sectors of the industry would be operating at their maximum capacity; alternatively if a reserve capacity of 5 percent were provided for, 520,000 tons of additional newsprint capacity and 1.75 million tons of capacity in the other sectors would be needed. So far as paper pulp is concerned, the additional requirements shown are subject to a number of qualifications; in particular, the possibility that substantial capacity for dissolving pulp may be devoted to the production of paper pulp. In Western Europe there would appear at present to be little margin for an expansion of paper pulp facilities and only limit-

TABLE 9. – TENTATIVE PRODUCTION/CONSUMPTION BALANCE FOR 1965

Commodity	North America	Western Europe	SUB-TOTAL	Latin America	Africa	Near and Middle East	Far East	Oceania	SUB-TOTAL	Rest of the world	TOTAL
	1	2	1 to 2	3	4	5	6	7	3 to 7	8	1 to 8
	in million tons										
Newsprint											
Production	9.23	4.66	*13.89*	0.53	0.07	0.06	1.12	0.23	*2.01*	1.83	*17.73*
Consumption	8.31	4.60	*12.91*	0.97	0.19	0.06	1.37	0.46	*3.05*	1.77	*17.73*
Net export (+) or Net import (—)	+0.92	+0.06	*+0.98*	—0.44	—0.12	—	—0.25	—0.23	*—1.04*	+0.06	—
Other papers and board											
Production	35.64	17.45	*53.09*	2.30	0.34	0.21	4.59	0.56	*8.00*	10.80	*71.89*
Consumption	35.38	16.75	*52.13*	2.51	0.64	0.21	4.72	0.71	*8.79*	10.85	*71.77*
Net export (+) or Net import (—)	+0.26	+0.70	*+0.96*	—0.21	—0.30	—	—0.13	—0.15	*—0.79*	—0.05	*+0.12*
Total paper and board											
Production	44.87	22.11	*66.98*	2.83	0.41	0.27	5.71	0.79	*10.01*	12.63	*89.62*
Consumption	43.69	21.35	*65.04*	3.48	0.83	0.27	6.09	1.17	*11.84*	12.62	*89.50*
Net export (+) or Net import (—)	+1.18	+0.76	*+1.94*	—0.65	—0.42	—	—0.38	—0.38	*—1.83*	+0.01	*+0.12*
Paper pulp											
Production	36.72	18.71	*55.43*	2.13	0.48	0.14	3.48	0.58	*6.81*	11.41	*73.65*
Consumption	36.20	18.10	*54.30*	2.33	0.35	0.28	4.28	0.70	*7.94*	11.41	*73.65*
Net export (+) or Net import (—)	+0.52	+0.61	+1.13	—0.20	+0.13	—0.14	—0.80	—0.12	*—1.13*	—	—

ed scope for additional expansion in newsprint and other paper and board. Moreover, changes in operating schedules may lead to an upward revision of the estimates of existing rated capacity.

20. The Consultation emphasized that undue importance should not be attached to the figures which had been arrived at, since these were largely hypothetical, resting on a series of successive assumptions and subject to explicit qualifications. Nevertheless, it believed that the exercise which it had carried out had been most useful, since it had clearly established:

(*a*) that expansion plans already afoot in the pulp and paper industry were sufficient to meet the major part of the increase in demand which may be expected up to 1965;

(*b*) the need to keep both demand trends and capacity development under continuous review.

21. So far as the presently deficit regions are concerned, the Consultation observed that the limited rise in net import requirements envisaged was conditional on the realization of ambitious current expansion plans (which connoted heavy investment programs), and did not allow for special government measures in certain of those regions which might cause paper requirements to rise more rapidly than the Consultation had assumed. In the developing regions, therefore, sustained efforts would be necessary if the rise in import requirements were to be kept within the limits imposed by the ability of those regions to import. Otherwise, consumption might have to be deliberately restricted, and economic, educational and cultural progress in those regions would be hampered.

22. Having concluded its review of prospects for 1965, the Consultation considered that the tentative supply pattern thus established, while subject to all the qualifications explicitly stressed in this report, nevertheless represented the most reasonable assessment it was possible to make with the information presently available of the world production/consumption balance as it is likely to develop by 1965. This tentative supply pattern is shown in Table 9.

Raw Material Supply

23. The Consultation noted that the long-term upward trend in consumption of pulp and paper might in some areas give rise to problems of raw material supply. Nothing is yet known, of course, of the likely trend in paper and board capacity during the decade 1965 to 1975, but the Consultation briefly reviewed, region by region, the possibility of industry obtaining the fibrous materials which would be required to satisfy demand as projected to 1975. It noted that improved utilization of long fibres and various technical developments in the pulp industry will serve to reduce dependence on long-fibred material by permitting a greater

use of short-fibred material derived from broadleaved woods, bagasse and agricultural residues, and that this trend would to some extent mitigate the supply problem in areas deficient in conifers.

In North America, recent exhaustive surveys (*Outlook for Canadian Forest Industries* and *Timber Resources for America's Future*) appeared to confirm that no major problems were likely to arise by 1975. In Western Europe, a recent survey carried out by the European Forestry Commission of FAO seemed less reassuring, since only a modest increase in total industrial wood output was foreseen to 1970 — considerably less, in fact, (apart from exports and imports) than would be required to meet the extra pulpwood needs arising from the projected increase in demand. Though the Commission itself had noted that its estimates of future output were conservative, and that there were many elements of flexibility in Europe's wood supply, the Consultation foresaw the need for intensive efforts in the coming years if the longer term needs — to the end of the century — of industry were to be met. Though considerably more use is to be made in Eastern Europe of non-wood fibres, felling forecasts and pulping capacity expansion plans indicate that serious problems may arise in covering pulpwood needs.

Latin America has ample resources of short fibre, and though in the short run difficulties may be experienced in satisfying long fibre needs these may eventually be overcome by supplementing natural conifer resources with plantations. In central and south Africa, short fibre resources are ample and extensive planting of conifers seems likely to take care of long fibre needs; the fibrous materials available in North Africa, however, are insufficient and limited to esparto, eucalypts, reeds, bagasse and other agricultural residues. The Near and Middle East is chronically short of fibre and, in spite of the use of non-wood materials and the limited forest resources not yet exploited, only extensive planting can provide a basis for long-term expansion of domestic pulp production.

Many countries in the Far East already experience difficulties in fibre supply. The industry in Japan is confident that its future needs can be largely met from forest resources still untapped and through increasing use of hardwoods, though a continuing need of pulpwood imports is foreseen; energetic afforestation programs are under way. In India, the industry is already based mainly on non-wood fibres, principally bamboo; a greatly increased use of bagasse is foreseen. Even so, fibre supply is likely to remain the principal preoccupation of the pulp industry in that country. In Oceania, the pulp industry is presently based on conifer plantations in New Zealand and on eucalypts, supplemented by long-fibre pulp imports, in Australia. Planting programs under way or being contemplated should secure the long-term raw material basis of the industry.

The U.S.S.R. has no shortage of suitable fibres, since besides possessing the world's largest reserve of conifers it has large areas of unexploited broadleaved forest and a great variety of non-wood fibres. Mainland China, deficient in forests, makes extensive use of straw, bamboo and other non-wood materials, the long-term outlook is good, since very large afforestation programs are under way.

24. Concluding its brief review of the long-term supply problem, the Consultation noted that difficulties already existed, or might arise by 1975, in Western and Eastern Europe, in the Near and Middle East and in areas of the Far East. Because of the time necessary for measures to raise forest output to take effect, the Consultation emphasized the importance of making long-term plans to secure the industry's future raw material supplies. It further requested the Secretariat to draw the attention of those concerned with forest policy to the raw material implications of the demand projections contained in this report.

Investment

25. The Consultation noted that the demand projections not only raised questions of future fibre availabilities, but implied heavy investments in industry. The rise in regional and world demand foreseen for the decade 1955/65 corresponds to the installation of additional industrial capacity at an average annual cost (at current prices) of more than a $1,000 million. In the ensuing decade, annual investment requirements may rise to an average of some $1,500 million (again at current prices). These figures do not include the substantial investment that will be necessary to develop the fibrous material resources. Over the two decades, roughly half of this investment would be required in North America and Western Europe. It is in the deficit regions, however, that investment needs will rise most rapidly. In Latin America, for example, approximately $65 million would be required annually up to 1965 on average, and $120 million annually between 1965 and 1975. It thus seems that, having regard to the limited capital resources available in developing countries and the competing claims on those limited resources, there will be both scope and need for investment from overseas.

International trade

26. Developments in international trade in pulp and paper were reviewed by the Consultation on the basis of Secretariat Paper FAO/WPPC-59/4: "Trends in Pulp and Paper Trade" and accompanying basic tables.

It noted that international trade in pulp and paper had grown to the point where, at close on $3,000 million, it accounts for over 3 percent by value of total world trade; this compares with less than 5 percent for iron and steel, 10 percent for all fuels; and 16 percent for all trade in food.

Trade in pulp and paper plays a vital role in the

economies of the major pulp-and-paper-exporting countries, accounting, for example, for one fifth by value of all exports from Canada, one fourth from Sweden, and nearly one half from Finland. It is also of vital importance to the deficit regions and there are few countries in the world that do not depend in some degree on imports to meet their essential needs.

During the past decade, determined efforts have been made in many of these countries to increase their domestic production of paper. As a consequence, the dependency on imports in these regions has fallen considerably, as is shown in Table 10.

Table 10. – Paper Imports as Percentages of Consumption

Region	1946/48	1956/57
Latin America	54	31
Africa	89	62
Near and Middle East	70	61
Far East, excl. Japan	64	54
Oceania	57	38

Nevertheless, in spite of the steps taken to increase their domestic supplies, net imports of paper into these regions have risen by 40 percent to 2 million tons over the last decade, while net imports of pulp have more than doubled, now exceeding 600 thousand tons.

27. The Consultation noted that in recent years the countries with fully planned economies had participated increasingly in international trade in pulp and paper. In 1958, for example the U.S.S.R. and Eastern Europe exported close on 300,000 tons of both pulp and paper. These exports, however, were balanced by pulp and paper imports of roughly the same order. The Consultation noted that information available to the Secretariat suggested that net exports availabilities in these areas on a scale likely to affect world market stability were not likely to arise in the coming years, having regard to the rapidly rising domestic requirements in those regions.

28. The upward trend in interregional trade in the postwar decade has been accompanied by rapidly expanding intraregional trade in North America and Western Europe. Thus, the total level of world trade in wood pulp now stands at 7½ million tons, as compared with 4½ million tons a decade ago and 5½ million tons before the war, while world trade in paper and board has reached over 10½ million tons, compared with 6½ million tons a decade ago and 6 million tons before the war.

29. Several participants expressed the view that current trends towards economic integration in Europe and elsewhere might eventually lead to significant changes in the trade flows described in the Secretariat paper. Participants from countries associated with both the European Economic Community and with the " Outer Seven " pointed out that the arrangements contemplated or already initiated were in no way intended to lead to the establishment of " closed economies " but rather to serve as steps towards an expanding world trade. This process would be accelerated by the rising requirements which would flow from the economic growth that economic integration was expected to foster. Other participants expressed their gratitude for the explanation afforded. The Consultation considered that it might be useful to review from time to time the effects on trade in pulp and paper of progress towards economic integration.

Future Work of FAO in Pulp and Paper

30. The Chairman drew attention to the fact that discussions to date had brought to light a number of problems which called for periodic international consultation and continued study on an international plane, problems which hitherto had not received the attention at the international level warranted by the growing importance of the industry and the role it was called upon to play in contributing to rising welfare. He instanced, in addition to the recommendations set out in paragraph 11 of this report, the need for opportunities for international discussion, leading perhaps to international agreement, on problems of conversion factors and of defining capacity, for the collection and analysis on a world basis of information relating to existing capacity and capacity expansion plans, and for the periodic examination of medium- and long-term prospects for the industries, based on available information concerning demand and capacity trends. These, and other problems which subsequent discussions might reveal, required, in the Chairman's estimation, an intensification of FAO's work in pulp and paper.

The Chairman's views were unanimously endorsed by the participants, and the Consultation strongly recommended that the Director-General of FAO make appropriate provision for strengthening FAO activities in regard to pulp and paper in formulating future work programs. In developing its program, FAO should seek the help of national organizations and representatives of the industry, and participants had every confidence that this would be forthcoming. FAO's activities in pulp and paper should, as heretofore, be developed in full co-operation with other international agencies concerned to avoid duplication of effort. The representatives of UNESCO and OEEC had every confidence that their organizations would co-operate fully with FAO, affirming that such collaboration would prove of mutual advantage.

Many participants paid tribute to FAO's work in pulp and paper over the last decade as exemplified by the work of the Latin-American Advisory Group, and instances were cited of the valuable direct assistance which FAO had afforded Member Governments. The Consultation welcomed this evidence of the essential soundness of FAO's approach, noting that it had been

found necessary to restrain doubtful projects as well as to encourage viable projects.

The Consultation further recommended that FAO should establish an Advisory Group on Pulp and Paper, consisting of a small number of pulp and paper leaders, representing different regions of the world, to furnish guidance on the development of these activities. Participants believed that such an Advisory Group could be so constituted as not to require FAO to cover the cost of attendance of members.

The Assistant Director-General of FAO in charge of the Technical Department, undertaking to convey to the Director-General the views of participants, said that the importance of pulp and paper was fully recognized since pulp and paper, besides furnishing materials essential to cultural progress, were very relevant to the improvement of food production and distribution, and thus had a part to play in FAO's Free the World from Hunger campaign.

The Director of the Program and Budgetary Service explained the exigencies of FAO's budgetary procedures. He believed that pending the availability of regular program funds (which would be subject to Conference approval) a modest start might be effected by using any special resources that may be placed at FAO's disposition.

It was decided that the report of this Consultation be placed before the next session of the FAO Conference at Rome in November 1959, and participants undertook to see to it that representatives of their governments were properly briefed regarding their views in this matter and their desire for an expansion of FAO activity in pulp and paper in the budget for 1962/63, if not before.

Participants and Advisers

Argentina:	Umberto Pomilio, Director, Celulosa Argentina, Sindacato Celulosa Pamilio
Australia:	Rodney Wilton Henry, General Manager, Australian Newsprint Mills Ltd.
Brazil:	Oscar Lorenzo-Fernandez, Co-ordinator, Pulp and Paper Study Group Development Council
Canada:	Ian B. Chenoweth, Canadian Pulp and Paper Association
	Robert M. Fowler, President, Canadian Pulp and Paper Association
Finland:	Johan Otto Söderhjelm, General Director, Central Association of Finnish Wood-working Industries
France:	P. Germain, Président, Union Syndicale des Fabricants Français de Pâte à Papier
Germany, Federal Republic of:	Horst Miethammer, Director Aschaffenburger Zellstoffwerke
	Ernest Robert Vogt, Representative of the German Pulp and Paper Association
India:	Amar Nath Kapur, Development Wing, Commerce and Industry Ministry
	Vishnu Prasad Podder, Works Manager, Dalmianagar
Italy:	Vincenzo Amici, Technical Director, Ente Nazionale Cellulosa e Carta
	Alfonso Froncillo, Conseiller, Direzione Generale Economia Montana e Foreste
	Giorgio Schirillo, Ente Nazionale Cellulosa e Carta
Japan:	Ktasumi Ashina, Adviser, Japan Paper and Pulp Association; Liaison Manager, Jujo Paper Manufacturing Co.
	Motoki Matsunaga, Executive Director, Japan Paper and Pulp Association
Norway:	Olav Trygve Jarlsby Managing Director, Saugbrugsföreningen
Sweden:	Ewert Landberg, Managing Director, Swedish Paper Mills Association
	Lars Sjunnesson, Director, Swedish Cellulose Association
Union of South Africa:	Francis Seymour Laughton, Under-Secretary for Forestry
United Kingdom	Sir Herbert Hutchinson, Director-General, British Paper and Board Makers' Association
United States of America	Robert O'Connor, Executive Secretary, American Paper and Pulp Association
	James J. Ritchie, Executive Director, U.S. Pulp Producers Assoc. Inc.
	Walter W. Sohl, Second Secretary of U.S. Embassy, Rome, Italy,
	Gabriel J. Ticoulat, Senior Vice-President, Crown Zellerbach Corp., San Francisco, Calif., U.S.A.
	P. Lawson Turcotte, President, Puget Sound Pulp and Timber Co., Bellingham, Wash., U.S.A.
Uruguay:	Giorgio Diena, Ing. Pamer S.A., Montevideo, Uruguay
OEEC	Ragnar Lagergren, Chairman, Pulp and Paper Committee, OEEC, Paris, France.
UNESCO	Alfredo Picasso-Oyague, Division of Free Flow of Information, UNESCO, Place de Fontenoy, Paris, France

The Work of FAO

European Forestry Commission

In welcoming delegates to the Tenth Session of the European Forestry Commission at Rome in July, the Director-General of FAO said: "I am happy to note that you have scheduled a discussion on the impact on European forest policies of current trends towards economic integration. These developments, which are by no means confined to the six countries of the European Economic Community, nor even to the European continent, have aroused great hopes and expectations on the part of those countries participating. At the same time, they have raised some apprehension on the part of nonparticipating countries. It is right that these matters be discussed frankly and openly. So far as forest and forest industry policies are concerned, there is no more appropriate forum in Europe than your Commission. The central problem is how to ensure closer association without prejudicing the interests of others. So far as forest products are concerned, the neighbors are not only European, since Europe has close and important links through the forest products market with countries in every region of the world."

The Chairman of the Commission, Mr. Alberto M. Camaiti (Director-General of Forests, Italian Ministry of Agriculture and Forests) expanded further on this theme, and the Commission heard a statement made by Mr. Herbignat (Director-General of Waters and Forests, Belgium) on behalf of the member nations of the European Economic Community (EEC). In this statement he stressed the desire of the Six to collaborate widely and openly — as has been done to date — in the study of the general problems undertaken under the auspices of FAO. But an exchange of views now on the possible repercussions of the initiatives of the Community on the present and future forest policies of all the European countries, would be premature. The conference of forestry experts held in Brussels earlier in the year had agreed on the need for a common study of certain forest policy problems, but the governments concerned were not yet committed, as the final report of the meeting had still to be approved by the Council of Ministers of the EEC. After this approval, the European Forestry Commission of FAO would be informed of the solutions envisaged for the problems which are of particular concern to the Six, within the general framework of the provisions of the Rome Treaty. The matter should therefore be a prominent feature of further sessions of the EFC.

This Tenth Session of the EFC was held at FAO Headquarters in Rome from 7 to 10 July 1959 and at the Italian Academy of Forestry Sciences in Florence on 13 July. A field trip was organized on 11 and 12 July by the Italian Forest Service to inspect afforestation and watershed management works on the Tuscan Apennines, and to enable members of the delegations to take part in the *Festa della Montagna* (Mountain Festival) for Central Italy, which was celebrated at Vallombrosa on 12 July.

Some 50 delegates from 21 member countries participated, representing: Austria, Belgium, Denmark, Finland, France, Federal Republic of Germany, Greece, Ireland, Israel, Italy, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Tunisia, Turkey, United Kingdom (Great Britain and Cyprus), and Yugoslavia. Mr. Egon Glesinger, Director of the Forestry and Forest Products Division, represented FAO.

The Commission had a very full agenda, including a review of the activities of its several subsidiary and technical bodies. The main feature of the session was the consideration of the national progress reports submitted by member countries, and the Commission felt that this year's reports were in general thorough, some giving very detailed information.

On the whole, forest policies had differed little in the period under review from those of previous years, but there had been a tendency for better co-ordination between agricultural and forestry interests, or rather for these factors to be better integrated with the general economic and social policies of the various countries.

Austria, Western Germany and Greece reported very good co-operation between farmers, foresters and forest economists, and France, Portugal and Spain emphasized the existence of a better integration of forest policy with the general economy. Austria, for instance, aims at achieving this integration with the farm regarded as the management unit. Norway has formed a working party of foresters, agronomists and economists, whose object is to devise a land-use pattern which is best from the social and economic points of view. In Sweden, foresters, in liaison with agronomists, are making a census of marginal crop land to be set aside for afforestation, and the investigation has provisionally revealed that conversions might affect an area of 530,000 hectares. Spain has started discussions between agronomists and foresters in order to decide on land-use improvements. France has established efficient collaboration between the forest services and those bodies concerned with agricultural development within the *sociétés d'économie mixte*, which were created for the reclamation and development of certain regions. The new Turkish forest law enables land consolidation to be better planned. In Finland, a joint technical committee consisting of agriculturists, foresters and economists is studying what improvements can be made to the management of farms, which generally include fairly extensive forest areas.

In Great Britain, a statement of Government policy was recently made indicating that the new planting program of the Forestry Commission will henceforth be fixed for periods of ten years at a time (that envisaged for the next ten years will cover 535,000 acres, (216,500 hectares), of which 300,000 acres will be planted from 1959 to 1963 and 235,000 from 1964 to 1968); in addition, the regulations controlling the Dedication Scheme will be revised and the system of felling licences will be somewhat relaxed. In Cyprus, after a policy of protection, attention is being directed to the productive potential of mountain forests and the establishment of plantations of quick-growing trees in the plains. In the Netherlands, a new forestry law to replace the Forestry Act of 1922, has been put before Parliament. This law seeks to maintain a minimum wooded area for timber production.

Efforts towards expanding forest production have been directed mainly to private forestry and particularly to plantations established by private owners, without altogether neglecting the betterment or even the readjustment of the management plans for public or privately-owned forests. Subsidies for planting are on the increase, notably in Austria and Ireland, where they have been doubled.

The consolidation of forest holdings or the setting up of co-operatives or associations of different kinds were being encouraged, with a view to facilitating marketing, management, administration, logging or execution of improvement works. In Western Germany, funds were earmarked in 1959 for the formation of forestry co-operatives for the planting of marginal land and each State has a forest owners' association. The establishment of co-operatives in Poland aims at remedying the difficult situation of small private woodlands, which are extremely fragmented in this country. Sweden reported a new form of association: forestry management regions. Switzerland also supplied details on a number of possible forms of land consolidation, which was carried out on 1,500 hectares in 1957 and on an equal area in 1958. Great Britain soon hoped to set up an association of woodland owners on a national scale, to be the official organ in discussion between the owners, users of wood and the Forestry Commission. In Northern Ireland, efforts are being made to form a Northern Ireland Woodland Owners' Association. The establishment of afforestation co-operatives is encouraged in Turkey and particularly for the planting of poplars. A special section has been set up for the development of private forestry in Yugoslavia (1958), and the creation of co-operatives of private forest owners is also promoted. The establishment of *groupements forestiers* is becoming of increasing importance in France; there are at present 555, covering a forest area of 225,000 hectares.

Total roundwood production in Europe in 1958 was only slightly lower than that of 1957. But a heavy fall in production and trade in the two categories of small-sized roundwood (pitprops and pulpwood) was very clearly evident in the main exporting countries. Total production of pitprops fell by more than 1 million cubic meters, a feature by no means entirely accounted for by the heavy reduction in demand due to restriction on the production of coal in the coal-producing countries of Western Europe. Production of pulpwood suffered from the effects of restrictions on the production of woodpulp, and also from the fact that the pulp mills in several countries already maintained relatively large stocks of timber.

Specific recommendations

Other details reported to the Commission are fully set out in the final report of the session, which among other points recommends that:

1. FAO should pursue, in co-operation with ECE, studies on market trends and especially on the development possibilities and methods of exploitation and utilization of small-sized hardwoods of all species, giving particular attention to beechwood of all dimensions, and keeping in mind the possible impact of the results of these studies on the silvicultural methods and forest policy applied to hardwood stands.
2. Member Governments should examine the steps which could be taken to establish or strengthen the strictest possible control of the quality, and above all of the origin of the forest seed and plants sold on the open market, and particularly of those intended for export. FAO should organize, within the framework of the World Seed Campaign, an *ad hoc* meeting of representatives of research institutions and forest administrations to study the means to be applied, particularly at the international level, to strengthen the guarantees which should be given to the buyers and users of forest tree seed and plants.
3. The next session of the FAO Conference should define FAO's responsibilities in regard to problems related to wildlife management as affecting forest management.

The Commission elected Mr. J. Jungo, *Inspecteur général des forêts* of Switzerland, as its new Chairman until the end of its Eleventh Session, and Mr. Salvador Sanchez-Herrera, *Director General de Montes* of Spain, and Mr. A. Herbignat, *Directeur général des eaux et forêts* of Belgium, as First and Second Vice-Chairman for the same term of office.

Forest Working Techniques and Training of Forest Workers

The Joint FAO/ECE Committee on Forest Working Techniques and Training of Forest Workers which operates in collaboration with the International Labour Office (ILO), held its third session in Oslo, Norway, from 1-5 June 1959, followed by a field tour from 8-13

June. Mr. E. G. Richards (United Kingdom) was Chairman of the session, and in the absence of Mr. S. Jackson (United States), elected rapporteur at the Committee's second session, Mr. X. de Mégille (France) was appointed to act in this capacity.

The specialized reports tabled for the meeting and the technical discussions showed the trends that had developed since the Committee's last session in Moscow in 1957, in working methods and techniques, mechanization, forest workers' training and safety.

Methods for the study of forest operations and time studies of each phase of operations, in use for many years in some countries and particularly in Scandinavia, are being developed more and more. The elaboration of performance tables is a natural corollary of time studies and it helps in the rationalization of forest work.

The problem of mechanization appears to be assuming ever greater importance in all countries. The development of power saws, especially, has been considerable over the last two years but delegates listed a number of negative factors, such as noise and vibration, as well as the position of the worker when operating the saw. In one country, a detailed study of the handle positions was made.

Alongside power saws used for felling only, portable brushcutters have been tried out in almost all the countries represented on the Committee. The results obtained so far differ widely and in some cases have been considered inferior, or at best equal to manual work. This emphasizes the need for comparative studies of brush-cutting operations. The problem of barking has also been under close consideration in many countries. In some areas where mechanization has been well advanced for quite some time, the techniques of barking have apparently been solved at the industrial level, but in others, trials are still being made both on methods of work and on machines.

Regarding the use of tractors in forest operations, a new development has been the use of mono-axial tractors with wheel-drive-trailers. Their use appears to be spreading and is said to be economically justified in skidding and transport of small size timber where hitherto the costs of horse-drawn units have been generally lower than those of tractors. As far as larger tractors are concerned, preference seems to be for tractors with four-wheel drive, as being machines better adapted to conditions that prevail in European forests. They may be used for skidding and transport to the point of utilization. Nevertheless, for work of a particular type, some specialists still prefer crawler tractors. Tractors are increasingly being used for soil preparation in afforestation and reforestation and even for the maintenance of tree nurseries. Mechanization of such traditionally manual operations seems to have been proved to be economic.

Apart from transport proper, there is an increasing trend towards mechanization of handling operations. In bundling of loads, in the development of small tractor-mounted cranes and even in short-distance skyways, there is evidence that technicians are showing increasing interest in organizing operations on the basis of specifically designed equipment rather than by adapting equipment already available to the specific working requirements. Working procedures are all aimed at getting maximum efficiency.

As a consequence of these changes in the organization of forest operations it is becoming more than ever necessary to train forest workers and foremen thoroughly and the development of training must be kept in step with mechanization. Since the last session of the Committee, new schools have been created in many countries, or special courses are arranged to suit local conditions. Light equipment, such as protective helmets for workers, plastic wedges, etc., are coming to be much more familiar, easing the job of forest workers and giving increased safety.

After a thorough discussion of the functions and program of the Joint Committee, it was decided to streamline future work and enquiries. The following study groups, each having a membership of 8 to 10 countries, were agreed:

Methods and Organization of Forest Work (Mr. J. Jindra, Czechoslovakia)

Manual and Mechanized Forest Operations (Mr. I. Samset, Norway)

Forest Machinery Development (Mr. X. de Mégille, France)

Vocational Training and Prevention of Accidents (Mr. H. Frølund, Denmark)

Multilingual Glossary of Forest Work Science (Mr. U. Sundberg, Sweden).

It was further agreed that it might be necessary to convene from time to time *ad hoc* working parties, comprising all participating countries, in order to deal with specific projects of particular importance, such as the elaboration of agreed criteria for the testing of forest machinery.

The Committee noted the elaboration of a definite version of a *Protocol for the Testing of Forest Tractors* which was being published. This should not require review for a considerable period after tests on a comparable basis had been carried out in the various countries.

Provisional protocols have also been issued in regard to the testing of winches, power saws, and barking machines. Preparation of a testing protocol for chipping machines has been started and preliminary work done on a scheme for brush-cutting machines. The Committee recommended action also in regard to the testing of limbing machines and machines for soil preparation and planting.

The Committee noted with appreciation the publication of the following studies:

The Mechanical Loading of Timber on Trucks, M. Kantola (Finland)

The Use of Power Saws in Forest Operations (3rd report), J. Jindra (Czechoslovakia)

Timber Skidding by Tractor in the U.S.S.R., K. I. Voronitsin, P. A. Lepentsov and M. A. Perfilov (U.S.S.R.)

It received progress reports on a number of other technical studies still in course of preparation.

The Committee approved the holding of an international course for the training of forest personnel and instructors in mechanized forest operations, under FAO/ECE/ILO auspices, in Sweden in the autumn of 1959. It expressed the highest appreciation of the ILO fellowship scheme for forest personnel to study abroad and the international courses organized jointly by FAO, ECE and ILO. ILO was invited to extend its fellowship scheme to cover the study of accident prevention, and to consider the possibilities of organizing an international training course on vocational education in forestry. ILO and the World Health Organization (WHO) were asked to give attention to questions concerning the health and welfare of forest workers, and in particular the physiological problems relating to forest work.

As regards accidents to forest workers, the Committee noted that forest accident rates are among the highest of all occupations. It is essential that these rates be reduced in order to prevent suffering of workers and their dependents; introducing safer and more efficient methods will also reduce loss of production. Greater uniformity in accident prevention terminology would expedite collection and analysis of statistics, and prevention programs can be best prepared where adequate accident statistics designed for this purpose are available. A practical system of reporting and analyzing forest accident statistics was recommended by the Committee.

Representatives from the following countries participating in the Timber Committee of ECE and the European Forestry Commission of FAO attended the session: Austria, the Byelorussian SSR, Czechoslovakia, Denmark, the Federal Republic of Germany, Finland, France, Italy, the Netherlands, Norway, Poland, Sweden, Switzerland, the Union of Soviet Socialist Republics, the United Kingdom and Yugoslavia.

Silviculture Modified by Mechanization

In building up and maintaining forest productivity, silviculturists and forest administrators must consider taking advantage of such developments as mechanized equipment. This makes possible more intensive silviculture on a given area at lower per-unit costs. It can, in some situations, make extensive silvicultural treatments practicable over larger areas with the labor force available. In such phases of forest management as combatting insects, diseases, and fire, modern equipment permits quick and complete action which has heretofore been impossible by hand labor.

Fortunately for the purposes of this study tour, the Joint FAO/ECE/ILO Committee on Forest Working Techniques and Training of Forest Workers, in which all member countries of the European Forestry Commission participate, has been conducting important studies and tests of machinery and in methods of training forest workers to meet the needs of forest managers and operating foresters. The reports of that Committee have been available to member countries. Thus the study tour was able to concentrate on modification of silvicultural practices, and not on the details of the machinery employed.

The discussions led to agreement that the early fears and misgivings of silviculturists towards widespread mechanization were unjustified. Instead of leading to "standardized silviculture" and clear-cutting on large areas, or to the disappearance of mountain protection forests, mechanization properly applied can bring about exactly opposite results. A more "individual" silviculture has been made possible through better road networks constructed by machinery and through a rational combination of the mechanization of felling, hauling and transport. Control of weed species can be carried out effectively through powered brushcutters, and even by chemical spraying from airplanes where conditions are suitable.

Among the factors favoring mechanization are lack of manpower or its loss to competing industries, higher wages and contractors' charges, general technical evolution towards higher living standards which causes workers to shun heavy labor, the impossibility of deep plowing or skidding of heavy logs by handwork, and the more consistent quality of work performed by machines than by man. On the other hand, mechanization is not favored where there is a surplus of forest workers, where wages in agriculture or forestry are low, where capital for the purchase of machinery is lacking (as with forest woodlot owners although this is being solved in some countries by means of co-operatives), where there are patterns of small or scattered forest ownerships, where forests are on steen or rocky terrain or where there is a lack of properly designed and tested machines of home manufacture.

Further work is needed to develop efficient techniques of using machinery in certain forests, particularly those with a large mixture of species and where selection of individual trees for felling with small regeneration areas, is the prescribed silvicultural system.

The advantages of mechanization can be better exploited where owners of small forest holdings group their woodlands into larger units for operation and management purposes, where tending and other silvicultural operations are carried out over concentrated units, and through the careful planning of the use of machines and man-power in relation to road construction, hauling of wood, and harvesting operations.

A report on the Study Tour has been issued.

Equipment Section

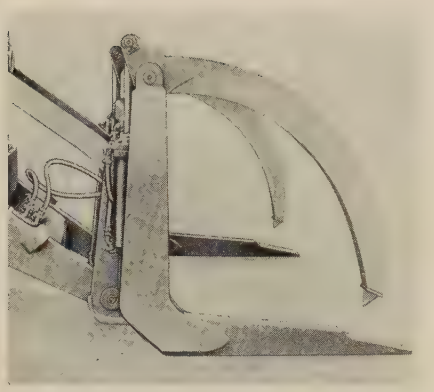
Hydraulic Chain 5 Ton Mobile Crane — Fits International Harvester W.6 Tractor or Fordson Major Tractor.

Dimensions: Over-all length (jib lowered and retracted) 18 ft. 9 in. (5.7 m.); over-all width 7 ft. 10 in. (2.4 m.); over-all height (jib lowered) 7 ft. 11 in. (2.4 m.); weight 5 tons 18 cwt. (5,914 kg.). Turning circle, 30 ft. (9.1 m.) diam. circle. Jib fabricated box section with 6 ft. (1.83 m.) telescopic extension. Weight 6 tons 4 cwt. (6,203 kg.).

International Harvester Co. of New Zealand, Ltd., P.O. Box 563, Christchurch, New Zealand.

Porter Cable Model 533 — A 7 ½ in. (19 cm.) saw adaptable to all types of cuts from long rip cuts to compound miters, powered by 13 amp motor; blade loaded speed 3,400 rpm. Depth of cut at 90° 2 $^{15}/_{32}$ in. (64 mm.) and at 45° is 2 $^{3}/_{64}$ in. (52 mm.). The saw equipped completely with precision ball bearings, is 19 $^{1}/_{4}$ in. (49 cm.) long, 6 $^{5}/_{8}$ in. (16.8 cm.) wide and 9 in. (23 cm.) high. Accessory equipment includes metal cutting blade, combination blade, crosscut blade, planer blade, rip blade abrasive blades, diamond hole blade adapter.

Porter-Cable Machine Company, Syracuse, New York.



Heavy-duty Attachment for Caterpillar No. 955 — Traxcavator. Intended specifically for handling large saw logs. Twin, hydraulically operated top clamps, available with log fork, permit handling of 72 in. (1.83 m.) diameter logs. Forward reach of fork at ground level 6 ft. 6 in. (1.98 m.) at max. lift height 6 ft. 3 in. (1.90 m.). With fork at highest position, load clearance height is 11 ft. 7 $^{3}/_{4}$ in. (3.55 m.).

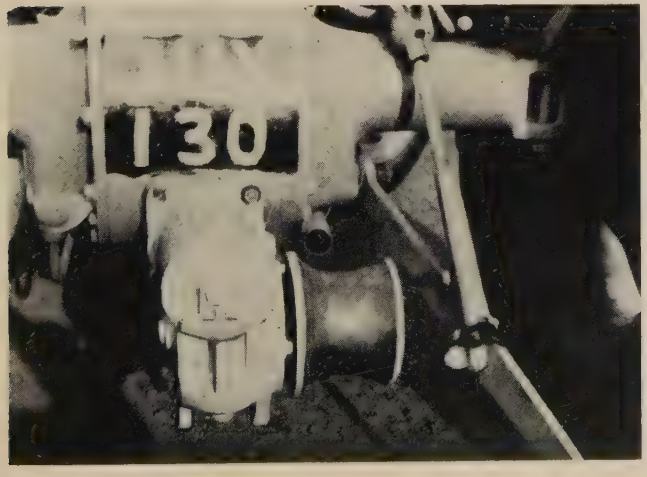
Caterpillar Tractor Co., Peoria, Illinois, United States.

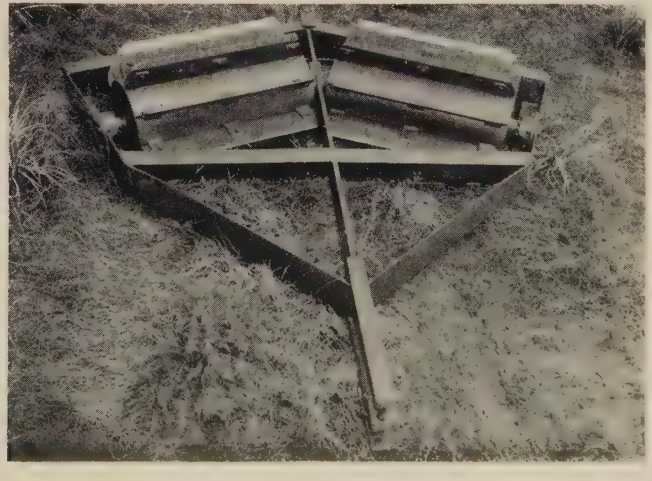
McConnel Capstan — Normally used with up to 300 ft. (91 m.) of left hand lay rope, exerts pull of up to 2,250 lb. (1,020 kg.). Driven by tractor's p.t.o. shaft and can be bolted on with drum vertical or horizontal. Usable for any jobs for which light winches are used, can be fitted in few minutes; does not tie up tractor. Light enough at 70 lb. (32 kg.) for a man to carry on shoulder. Particularly valuable for pulling out bogged tractors as driver himself can fetch capstan, fit it to bogged tractor and make it pull itself out using anchor, without disturbing work of other tractors or men.

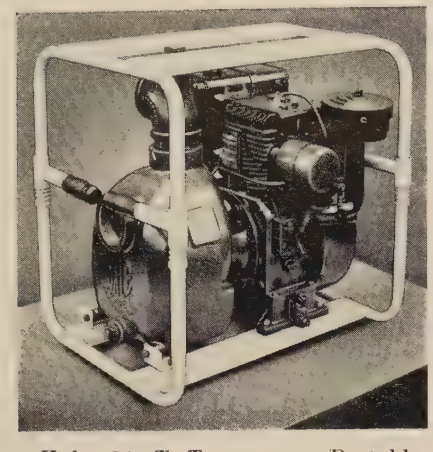
F.W. McConnell Ltd., 67, Chiltern Street, London W. 1.

Slice-O-Lator — The model illustrated weighs 1,600 lb. (726 kg.) without water, 2,000 lb. (907 kg.) filled with water, 2,500 lb. (1,134 kg.) filled with sand; individual watertight filling plug on each drum. Blades 6 in. (15 cm.) wide and 36 in. (91 cm.) long. Over-all length 10 ft. 8 in. (3.25 m.); over-all width 8 ft. 6 in. (2.60 m.); cutting width approx. 6 ft. (1.83 m.). Power required 20 hp. The Slice-O-Lator is available up to 4,200 lb. (1,905 kg.); 8 ft. (2.44 m.) cut with blades 10 in. (25 cm.) high.

M. and W. Iron Works, Inc., Deerfield Beach, Florida, United States.





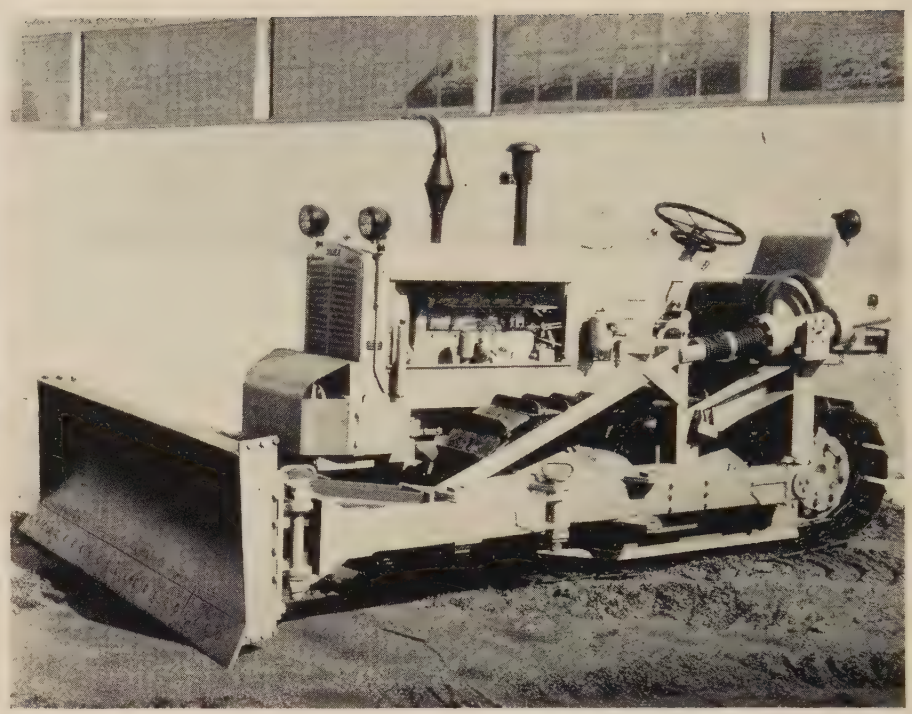


Hale 30 T Torrent — Portable pumping unit; pumps 20,000 g.p.h. (75,700 liters/h). Weight 143 lb. (65 kg.). Easily carried by two men or wheeled by one. Engine 9 hp. Approximate dimensions: length 24 1/2 in. (62 cm.); width 19 1/2 in. (49.5 cm.); height 25 1/2 in. (65 cm.).

Hale Fire Pump Company, Conshohocken, Pa., United States.

S.D. Freightlifter Heavy Duty Fork Lift Trucks, Models 82 and 100 — For handling and stacking timber. Capacity: Model 82, 15/18,000 lb. (6,800/8,164 kg.) at 24 in. (61 cm.). Model 100 18,000 lb. (8,164 kg.) at 33 in. (83 cm.). Engine: Diesel 65 bhp. or petrol 70 bhp. Principal dimensions: over-all height; fork raised, model 82: 24 ft. (7.3 m.); model 100: 28 ft. (8.5 m.). Outside turning radius: model 82: 14 ft. 3 in. (4.3. m.); model 100: 16 ft. 11 in. (5.2. m.). Weight unloaded: model 82: 9 tons 2 cwt. (9,224 kg.); model 100: 10 tons 5 cwt. (10,650 kg.).

Shelvoke and Drewry Ltd., Letchworth, Herts, England.



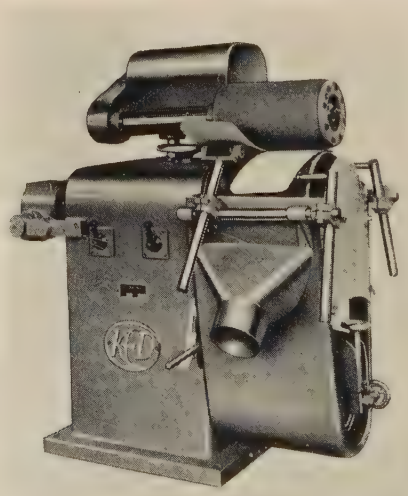
Famo "Boxer" Crawler Tractor — *Specifications* Engine: 4-stroke diesel. Performance: 46 belt-hp; speed: 4 from 1.82 mph. (2.82 km./h.) to 4.48 mph (7.21 km./h.); 1 rev. 2.24 mph (3.60 km./h.); max. drawbar pull 8,000 lb. (4,000 kg.). Dimensions of tractor: max. length, 114 1/4 in. (2,900 mm.); max. height, 72 3/4 in. (1,850 mm.); max. width, narrow gauge 47 5/8 in. (1,210 mm.); standard gauge 61 7/8 in. (1,565 mm.) 65 5/8 in. (1,665 mm.); wide gauge 82 5/8 in. (2,100 mm.). Ground clearance 11 3/4 in. (300 mm.). Weight of tractor with standard gauge 9,460 lb. (4,300 kg.). Turning radius 61 1/2 in. (1,550 mm.). May be fitted with cable winch, bulldozer and angledozer.

FAMO Vertriebsgesellschaft m.b.H., Buhlstr. 5-11, München 45, W. Germany.

Hyry Chain Saw — Direct drive. Blade length: 17 in. (43 cm.); weight 25.6 lb. (11.6 kg.); 6 hp/6000 rpm. Membrane carburetor, centrifugal clutch. Cylinder volume: 90 cc.

Chain made by: *Sandvikens Jernverks A.B. Sandviken, Sweden.*

Manufacturer: *Auto Koneistamo Oy, Helsinki, Finland.*



Automatic Oscillating Curve and Plane Sander — Serves an automatic sander of curved and straight bulkpieces such as chairbacks, arm-rests, trouser-stretchers, lasts, etc. *Specifications*: (Type XX/3) Useful sanding width, 12 in. (30 cm.); adjustable sanding thickness up to 4 in. (10 cm.); available feed rates, 26 and 52 ft./min. (8 and 15.8 m./min.); power of sandbelt motor, 4 hp.; power of feed motor 0.2/0.3 hp.; dimensions of sanding belt, 73 × 12.5 in. (1.85 m. × 32 cm.); total weight of machine, 1,000 lb. (454 kg.); over-all dimensions of machine, 28 × 47 in. (71 cm. × 1.2 m.).

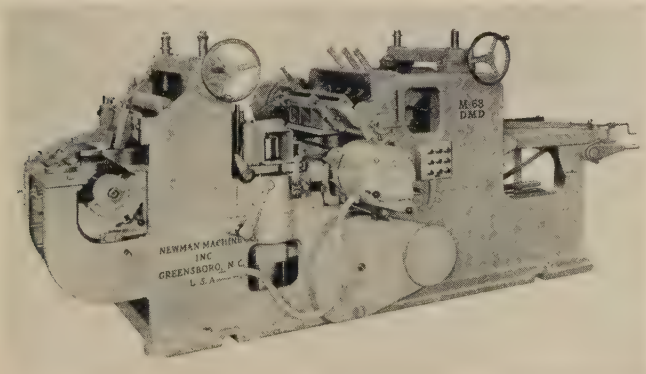
Kurt Ehemann, Spezialmaschinenfabrik GMBH, Delmenhorst, P.O. Box 184, W. Germany.

Vybak Semi-Rigid Transparent Sheet DVB. 229 — Specially developed for use as machine guards and windows. Based on a polyvinyl chloride resin and is a transparent, non-inflammable sheet, extremely resilient, resistant to water, chemicals and oils. Easily fabricated by normal methods, can be assembled or fitted by conventional means with or without frame. Curvature or radius obtained simply by warming.

Bakelite Ltd., 12-18 Grosvenor Gardens, London S.W.1.

M - 68 Planer and Matcher. — Medium speed machine. *Specifications:* 100 percent ball and roller bearing. Four or six knives - round cylinders. Feed works: six 8 in. (203 mm.) diameter feed rolls; feed speed 150 ft. (45.7 m.) per min. Stocks dimension sizes: maximum thickness 6 in. (152 mm.) minimum ¼ in. (6 mm.). maximum width 15 ¾ in. (400 mm.) minimum 1 ½ in. (38 mm.). Machine sizes 16 × 6 in. (406 × 152 mm.). Weight 10,000 lb. (4,535 kg..).

Newman Machine Company, Inc. Greensboro, N. Carolina, United States.

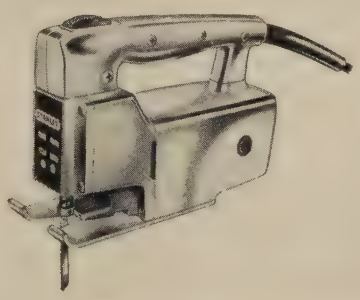


Alber Automatic Band and Circular Saw-Sharpening Machine — Sharpens normal gap and gullet teeth spaced from 3/16 in. (5 mm.) to 1 in. (2.5 cm.). Quick change of clamping devices for band resp. circular saw blades; for circular saws, all cutting angles adjustable by scale. Correct cutting angle for band saws rigidly set; drive by Vee-belts. Two feed speeds, 70 and 110 teeth/min., for circular saws from 4 in. (10 cm.) to 24 in. (61 cm.) in diameter, built-in motor A.C. triphase 220/380 V., 0.2 kW., with switch, tools and one grinding wheel mounted on flange with additional equipment for band saw blades of from 3/16 in. (5 mm.) to 1 3/4 in. (4.4 cm.) width and 1 grinding wheel mounted on flange.

Rudolf Alber, Ebersbach-Fils, Württ., W. Germany.

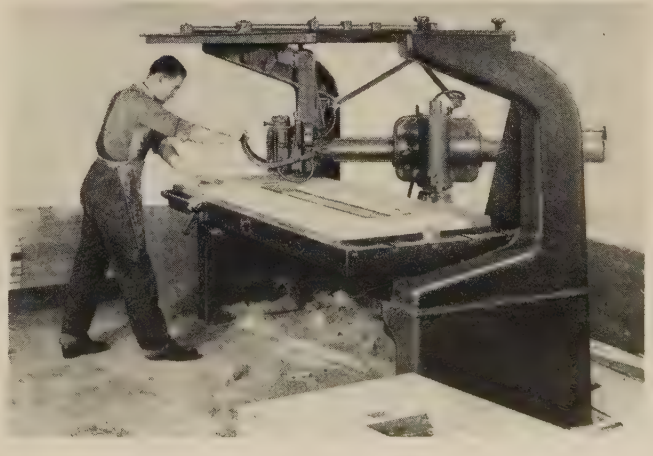
Stanley H75 Saber Saw — Cutting 3,300 strokes/min.; cuts 2 in. (5 cm.) lumber. Net weight 4 3/4 lb. (2.15 kg.). Blades available for cutting plastics, plywood, fibre, glass masonite, flush doors, aluminum, brass, copper, steel not over 1/2 in. (13 mm.) thick, rubber, felt and similar materials.

The Stanley Works, Export Department, New Britain, Conn., United States.



Wadkin High Speed Radial Router, Type 40S — Specially designed for cutting out window and letter-box openings on flush doors. Router head driven by motor giving speeds of 24,000 and 18,000 rpm. Head has vertical movement of 4 in. (10 cm.) by handle. Max. radius of arm: 4 ft. 5 in. (1.35 m.); min. radius of arm 20 in. (51 cm.); hp. of head 2-8 1/2; speed of head 24,000 and 18,000 rpm.; table size 7 ft. 5 in. × 3 ft. (2.26 m. × 91 cm.); net weight 3,808 lb. (1,727 kg.); gross weight 4,984 lb. (2,260 kg.).

Wadkin Ltd., Green Lane Works, Leicester, England.



News of the World

Cambodia

• A number of agencies and organizations are operating technical aid programs in Cambodia.

The United States Operations Mission (USOM) is mainly concerned with administering and giving funds and equipment to carry out approved projects. The major project is an aerial forest and land use survey involving full photographic coverage on the scale 1 : 40,000. For ground sampling and survey, one mile (1.6 kilometers) strips 10 miles (16 kilometers) apart on scale 1 : 10,000 completely cover the country. An FAO inventory specialist has been conducting complementary work mostly east of the Mekong.

A second project is the running of a school for rangers at Kompong-Cham. The school building has been completely renovated and training has started. The former ranger training institution at Phnom-Penh has been modified and raised to the status of a college for training of officer grades. The class consists of 10 to 12 men in each group on a 3-year course.

Scholarships and fellowships are given for further training in the United States and other countries, while study tours for senior officers are arranged to visit forests, industries, and research institutes in the neighboring countries of Japan, Philippines, Malaya, and Indonesia.

Fire protection is another project. One square kilometer of dry forest (Dipterocarps) in each division has been demarcated, fire lines and firebreaks cleared, and divided into subblocks for complete fire protection with the object of demonstrating to the public and the Government the benefits and techniques of fire protection. The complete cost — including labor, regular fire watchers, minor equipment, propaganda posters — is borne by USOM. Pumps, transport and equipment for mobile squads are available.

Afforestation with *Pinus merkusii* of grasslands on hillsides and plateaus denuded as a result of recurrent shifting cultivation in the past, is an important project started this year. Mechanical planters, holeborers, pumps, etc., are on order.

An access road program is designed to open up rich evergreen rain forests and pine forests to exploitation. Numerous stretches of forest road have been constructed and are being extended. A 220-kilometer highway linking Phnom-Penh (the capital) with Kompongsong on the Gulf of Thailand in the southwesterly direction has been just completed.

FAO's Regional Forestry Officer reports that the Colombo Plan is furnishing equipment for a forest products laboratory — consisting of such machines as timber-testing machine, seasoning and impregnation, peeling and plywood-testing machines, supplied from Princes Risborough, England. The construction and provision of adequate buildings is being negotiated.

French bilateral aid is rendered for the exploitation, management, and treatment of the rich evergreen rain forests on the west coast, opened as a result of the building of the port of Kampongsong (also by French aid) and the construction of the American highway. Heavy equipment, caterpillar tractors, yarders, etc., are available. French foresters also assist in the teaching of forestry at the Forestry College and School.

Aid is also being received from China in constructing a pulp and paper mill and plywood plant. The mill is said to be based on bamboo and rice straw, with an annual capacity of 12,000 tons. Plywood raw material will be Dipterocarps, mainly yang. Various forest roads are also being constructed or repaired through financing by China.

The Japanese are assisting to exploit the evergreen rain forests north of the port of Kampongsong, for exports to feed the plywood mills in Japan.

Federal Republic of Germany

• It is a very considerable time since a monograph has appeared on the European oaks, *Quercus robur* and *Quercus sessiliflora*, whose economic importance has tended to decline. Although still among the most valuable forest species of Europe, the disadvantages of slow growth and long rotation weigh against them, however desirable they may be silviculturally.

A new comprehensive volume on the oaks (*Die Eichen - Forstliche Monographie der Traubeneiche und der Stieleiche*, by J. Krahl-Urban, Paul Parey, Hamburg/Berlin, 1959) deserves the attentions of European foresters. It presents the silvicultural, technological and economic aspects of oak growing under European conditions, based on the author's own wide experience and all the relevant literature.

The geographically arranged bibliographical list comprises close to 500 titles in the German language (from Germany, Austria, Switzerland and some translations), plus about 300 titles from 15 other European countries.

France

• *La Fumure en Sylviculture* (Fertilizers in Silviculture) is a 71-page document put out by the *Société Commerciale des Potasses d'Alsace*. It summarizes the existing literature at present available from all sources on the use of fertilizers in silviculture and the results obtained, distinguishing between the use of fertilizers in the nursery, in plantations, and in natural regeneration, according to the site conditions and the various forest species involved.

No firm conclusions can as yet be drawn but the large number of experiments already carried out seem to show that mineral fertilizers can profitably be used in the forest and to indicate the desirable dosages according to the soil and tree species. For instance, Japanese larch has a low requirement for potash but Douglas fir has a high requirement and reacts strongly to treatment.

Experimentation with the use of fertilizers is increasing along with the trend towards intensive silviculture, and it is expected that the subject will receive thorough discussion at the Fifth World Forestry Congress.

Ghana

• A report to FAO says that the high exports of mahogany and other valuable timbers in recent years have to a considerable degree come from the clearance of all marketable trees on unreserved forest land which was being cleared for agricultural purposes. This kind of exploitation is nearing its end and was wasteful as only a small proportion of the land cleared was exploited by timber operations before being farmed.

The sustained yield from the reserved land is estimated on the present stocking to be only a quarter to one third of the cut in recent years and it is necessary to increase this yield by proper silvicultural treatment, which is a long term process. The species preferred by the export trade form only a small part of the exploitable timber, but species previously neglected are increasingly used by the sawmills. They contributed nearly 31 percent of the sawmill output in 1957. Utilization of timber has also become more diversified. A new plymill is expected to have begun production by the latter half of 1960. The furniture industry is expanding and the manufacture of wooden lorry bodies and tool handles making progress. A match factory was completed in 1957.

Better use of timber resources is one of the main objectives of the Ghana Timber Utilization Branch, which is being developed. The Branch also studies the treatment of timber to increase life and improve quality, technical improvements in sawmilling and transport, and the development of industries using waste products. Progress is being made in installing and using new equipment, and the work of the Branch will be all the more necessary if, as is anticipated, the forests outside the reserves are destroyed during the next decade or two. In 1957, a Ghana Timber Marketing Association was formed to export and market logs of the small producers with a substantial Government guarantee, but it ran into difficulties. The problem of securing a uniformly high standard of efficiency in felling, transporting and treating timber is not yet solved. The Timber Utilization Branch can be expected to raise the standard by degrees as more contractors and sawmill owners profit by its advice and demonstration methods.

The need for poles to construct local houses and the supply of fuel to the growing towns is receiving close attention but the establishment of plantations is not always a simple task. The increasing importance of tobacco cultivation has made the supply of fuel for tobacco a matter of importance and urgency in certain regions. The cost of fuel can be a major question in the economics of tobacco growing.

India

• Under the First Five Year Plan, soil conservation work was accorded the priority due to it in the scheme of national development. With the setting up of the Central Soil Conservation Board by the Ministry of Food and Agriculture towards the end of 1953, the stage was set for carrying out soil conservation work on systematic lines. The Board assisted the state governments and river valley authorities in preparing plans, provided for the training of technical personnel, acted as a clearing-house for information and recommended financial assistance for state schemes. It also made itself responsible for research, demonstration and extension work in soil conservation. The state governments also set up their own soil conservation boards.

An official report to FAO makes special mention of the desert afforestation and soil conservation research station at Jodhpur which was reorganized in 1956 so as to take up experimental works on shelterbelts, afforestation of sand-dunes, and pasture development. With the experience gained at the station on problems of desert development, a scheme for reclamation and control of the Rajasthan desert was drawn up early in 1957 in consultation with two experts from the United Kingdom and an FAO expert. Demonstration areas within the community development blocks have been started so as to popularize the correct techniques of improving pastures by regulation of grazing and adoption of proper management methods.

The First Five Year Plan had emphasized the desirability of conducting a soil and land utilization survey of the country for executing a long-term program of soil conservation, as also for the wider objective of improving and increasing crop yields. Early in 1957 a scheme for land use survey and planning with the necessary administrative set up was sanctioned. This has since been integrated into an All-India Soil and Land Use Survey Scheme to carry out soil surveys for four major groups of soils, namely black, red, alluvial and laterite soil groups. It also aims to conduct soil conservation surveys for planning and land use in the catchment areas of the six river valley projects, namely Kosi, Damodar, Chambal, Bhakra, Machukund and Hirakud.

Libya

• Improvement of forests and other natural vegetation is not easy in a country with climatic and soil conditions such as Libya's. FAO forestry advisers have been assigned to Libya to advise on the administration of forest services and of forest policy. Their reports and recommendations are a guide to forest policy in Libya for the present and for some years to come. The experts have prepared draft forest laws for Tripolitania and Cyrenaica, the first of which has now been enacted. They have also drafted a Federal Forest Law and a Soil and Water Conservation Law which are now under consideration by the Government. The experts have prepared a plan of management for the esparto-grass areas, and a start has been made with putting it into operation. Esparto grass is one of the main export commodities of Libya. Improved techniques for sand dune fixation, experimental plantings in arid areas and planting trials have been successfully introduced by the experts who have also spent some time on ecological studies. They have paid much attention to training of forestry personnel: eight FAO fellowships and one British Council scholarship have been awarded to Libyans since 1953.

Norway

• The State maintains three forester training schools situated at Kongsberg (Buskerud county), Evenstad (Hedmark) and Steinkjer (Nord-Trøndelag) where the length of the course is one and-a-half years. The County of Oppland also has a training school at Brandbu which in addition to the normal term of one-and-a-half years provides for an advanced course of six months' duration.

Each course usually includes about 30 men. Those who pass the final examinations — forest technicians — take up posts mainly in private forestry, with forest owners associations, or are employed in forest survey work etc. Some of the pupils are forest owners themselves or are likely to inherit forest property.

The requirements for admission to the four forester training schools mentioned above, are a satisfactory educational standard together with one year's experience as a forest worker.

In addition to these courses, there is a state school at Osen (Hedmark) with a 10 months' course, the purpose of which is to give the pupils practical experience of forestry. This course makes them eligible for the forester training schools.

Short courses of four to six weeks are held at the Vocational School for Forest Workers at Sønsterud (Hedmark). Here pupils are taught the proper use of tools, modern felling methods, etc. The vocational training school is administered by the Ministry of Church and Education, whereas all other schools of forestry are under the administration of the Ministry of Agriculture.

UNITED STATES: *The William B. Greeley Memorial Laboratory, Yale University, New Haven, Connecticut (see text).*

Instruction in forestry is also given in all agricultural schools.

The degree in forestry is obtained at the forestry section of the Agricultural College of Norway and this course lasts three years. An entrant to the college must have reached the university entrance standard of education, and in addition must have passed the examinations of a forester training school and have had two years' practical experience of forestry. Students are admitted only every second year (1957-1959...) and there are about 30 to 40 in each course.

Pakistan

• A documentary treatment of *Agriculture in Pakistan* has been published by the Ministry of Food and Agriculture. One of its 20 chapters deals interestingly with the forests of East and West Pakistan.

The largest stretch of forest in East Pakistan, the book says, lies in the Sundarbans in the delta of the Ganges and extends to over 2,000 square miles (518,000 hectares). The forest is of the tidal type and the trees grow very slowly. The principal tree, sundri (*Hertiera minor*), grows to only about 40 to 70 feet (12 to 21 meters) in height and 2½ to 4 feet (0.76 to 1.2 meters) breast height girth in about a century and a half. This timber can be used in boat building. When treated with creosote the small logs make excellent transmission poles.

The next tree of importance is gewa (*Excaecaria agallocha*). This yields soft timber which is used both as match wood and for pulping. A paper mill purchases 40,000 tons annually, and a newsprint mill set up at Khulna is using this wood as raw material.

Another small tree, goran (*Ceriops roxburghiana*) flourishes as an undergrowth. It yields a very high percentage of tannin from its bark and also produces firewood of very high calorific value. This tree grows so prolifically that the total annual tannin yield could not only meet all Pakistan's requirements but would also give a substantial surplus for export. An industry has not, however, yet been planned. Manufacturing of fibreboard and wood particle board is under consideration.

Forest work in the Sundarbans is hazardous because the forest is infested with tigers and the rivers and creeks with crocodiles. The forest floor is submerged twice a day, and during high tide work has to be stopped.

Turkey

• The Export-Import Bank of Washington, U.S.A., has allocated $4 million credit to assist the Turkish Forest Service to increase production of logs and other types of industrial wood under a five-year development program. This expansion is to take place chiefly in the six national forests of Bolu, Istanbul, Kastamonu, Trebzon, Belihesir and Nersin, where the largest areas of usable timber are located. It is expected that as the yield of Turkish high forests is expanded, increasingly large savings of foreign exchange may be realized by Turkey through a progressive reduction of imports of lumber and wood products and their ultimate replacement by sizeable, exchange-earning exports.

The credit will finance the services of a number of United States technical advisors as well as purchases of United States equipment to carry out programs in forest management, building of forest access roads, logging and sawmilling, reforestation, fire protection, and research.

An FAO technical assistance team has been working in all these fields for several years, and the country study for Turkey produced as part of FAO's Mediterranean Development Project envisages an integrated program of simultaneous action for cultivated dry lands, grazing lands, forests and irrigated areas.

Union of Soviet Socialist Republics

• A second volume of *Logging Mechanization in the U.S.S.R.*, by A. Koroleff, formerly Director, Woodland Research Division, Pulp and Paper Research Institute of Canada, brings up-to-date the author's review of research, development and practice of mechanized timber harvesting in the U.S.S.R.

The first volume, published in 1952 and reviewed in *Unasylva* (Volume 8, Number 2) was based on a literature review for the period 1947-1952 of technical articles appearing mainly in the monthly magazine, *Lesnaya Promishlennost* (FOREST INDUSTRY). The present work, covering the period 1952-1958, in addition to drawing on this and other U.S.S.R. publications, incorporates information obtained by the author while attending the second session and study tour of the Joint FAO/ECE Committee on Forest Working Techniques and Training of Forest Workers held in the U.S.S.R. in September 1957.

The author believes that logging in most countries has not received its proper share of the benefits of science and engineering and, generally speaking, is lacking in efficiency. He argues that only in the U.S.S.R. is concentrated research being conducted on logging mechanization, and that only in this country is the ideal system of full-tree logging (i.e. felling, skidding and hauling) being carried out on a commercial, even though small, scale.

According to the first volume, a fundamental principle of logging in the U.S.S.R. was that forest work should be self-sufficient in power. This was to be accomplished through generation of producer gas from wood for trucks, tractors and logging railways and portable or stationery (mainly producer gas but also steam) electrical stations. However, restrictions on the use of liquid fuel in logging were subsequently relaxed or lifted, and its use has increased. This has affected mainly power saws (used in the forests), trucks and tractors. Electricity is still regarded as most

efficient and electrification continues in many categories of logging.

The second volume emphasizes another important change in U.S.S.R. logging, that is, to remove much of the work to points outside the forest. By changing to full-tree skidding and hauling, the work is concentrated at the more efficient permanent lower landings, where earlier the wood was bucked at expensive temporary upper landings prior to hauling.

The author describes in considerable detail various logging methods, labor efficiency and productivity of the equipment, as well as details of equipment used for cutting, skidding (tractor and cable), hauling including truck, railway and water transport. The subject matter is covered in an easily readable form, and in certain categories in considerable detail. Similar information is contained in several films that have been produced by the U.S.S.R. authorities, and in publications of the Joint FAO/ECE Committee on Forest Working Techniques and Training of Forest Workers.

United Arab Republic (Egypt)

• A decree published in April 1959 embodies the establishment of the General Authority for Desert Development, with headquarters in Cairo. The new authority is entrusted with determining the desert lands which can be reclaimed and also drawing up an over-all policy for reclaiming, cultivating, utilizing and disposing of such lands.

It is understood that it will be responsible for carrying out drainage and irrigation projects, utilizing subsoil water, developing animal wealth, improving means of transport, encouraging existing industries and creating new ones. The authority will have an independent budget and will be operated on a commercial basis.

Also in April, the Central Minister of Industry signed a contract for the formation of a company which will establish a veneer factory at Mansura.

United Kingdom

• The Forest of Dean is one of the ancient royal forests, now much reduced in area and covering about 40 square miles (10,360 hectares). A committee was set up some time ago to review the situation in the forest and " having regard to all existing rights and interests, to recommend such measures as they consider desirable and necessary to secure that the administration of the forest, more particularly as regards the grazing of animals, may be adjusted to modern requirements ", and it has now reported to Parliament.

The committee found that the problems associated with the grazing of animals in the forest were more complicated than was originally expected. Sheep (estimated at 6,000 ewes and 4,000 lambs during the summer) are a feature of the forest, roaming unattended over large areas, in the towns and villages, and on the roads. The committee received evidence as to the extensive damage done to gardens and crops by straying sheep and the difficulty of identifying the owner of the animals responsible. Even when the owners have been identified, the compensation recovered was usually quite inadequate. To meet the situation in the case of housing schemes, greatly increased expenditure was necessary on both external and internal fencing. There were numerous complaints over the prevalence of traffic accidents caused by sheep straying on to the roads, especially at night. The committee was told that " the practice of allowing animals to stray on the ' common land ' is completely outdated and conflicts with the conditions obtaining in the area today ".

In its report the committee records the view that these various complaints are well founded in fact. Moreover, the roaming sheep involve the Forestry Commission in heavy expenditure in maintaining fences to keep the animals out of the enclosed woodlands. No person, whether owning or occupying land inside or outside the perambulation of the forest, had a legally enforceable claim to run sheep on the forest and this was done not by legal right but by sufferance of the Crown. Nevertheless, it would not be equitable to ignore the fact that sheep had been grazed on the forest for many years. The committee, therefore, made a number of recommendations which satisfy its main thesis that the sheep should be removed from the open forest and roads and from the towns and villages. Sheep should either be confined to special fenced enclosures or eliminated altogether subject to certain payments. A special commissioner should be appointed to compile an appropriate register of sheep owners, and quotas should be allotted to each registered grazier which should be enforced after two years (the committee envisage a quota as not exceeding 20 ewes or the equivalent in other stock, one cow or bullock being regarded as equivalent to four ewes). The indiscriminate running of pigs in the open forest should be brought under control by the registration of owners under similar conditions to those proposed for sheep owners, including allotting distinctive marks.

United States of America

• Earlier this year was opened the Greeley Memorial Laboratory, School of Forestry, Yale University, which honors a man who was Chief of the United States Forest Service from 1920 to 1928 and later took a leading part in promoting the national " tree farm " program for managed private forest land. The facilities of the laboratory will be used in connection with the School of Forestry's five-year project to increase the basic knowledge about forests. For this purpose, the National Science Foundation has given Yale University a $53,000 grant to conduct genetics research. Current tree improvement programs are financed to a great extent by wood-using industries, and have as their goal the selection of superior commercially important trees for the establishment of seed orchards. The Yale Project envisages the production of basic data on forest tree genetics.

Viet-Nam

• In the neighborhood of Saigon, there are over 200 small sawmills, furniture and shoe factories — either separately or in combination. The sawmills are mostly of the French horizontal electric saw type. The operators are very clever mechanics and skilful craftsmen.

Ornamental cabinet wood consists of *Pahudia cochinchinensis*, *Dalbergia bariensis*, *Pterocarpus* and *Diosyros* spp., *Cassia siamea*. Among the most popular general utility timbers are *Hopea odorata*, *Pentacme siamensis*, *Shorea obtusa*, *Dipterocarpus alatus*. For making women's shoes and sabots, *Tetrameles nudiflora* and *Sindora cochinchinensis*, and *Sandoricum indicum* are most popular.

For lacquer-ware, the oleo-resin is obtained from *Melanorrhoea laccifera* (in Burma the tree is *M. usitata*), and Viet-Nam produces one of the best and most beautiful lacquer-wares in the world, the FAO Regional Forestry Officer says. Formerly, bamboo-work was used as the framework, but nowadays fibreboard and plywood are invariably used, being cheap and readily available.

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